


MUSEUM DESIGN

DATA COLLECTION



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Museum

For Culture and Art

History Of Museums

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MUSEUMS :

A place which conserves artifacts and other objects of scientific, artistic , cultural or historical importance and makes them available for public viewing through exhibits that may be permanent or temporary.

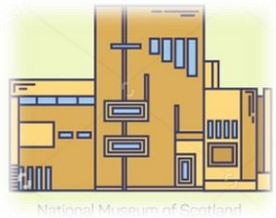
REF: http://www.academia.com/

PURPOSE :

The purpose of museums is to collect, preserve, interpret and display items for the education of the public on one's history.

HISTORICAL BACKGROUND :

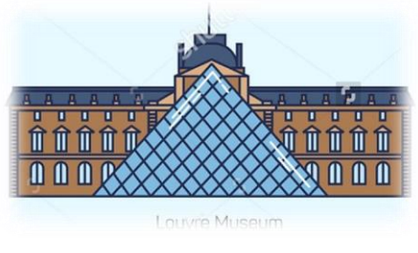
- Museums began as a private collection of wealthy individuals, families or institutions of art and rare of curious natural objects and artifacts.
- In the ancient time period, these private collections gained a higher social status in the world.










TYPES OF MUSEUMS :

An art museum is a space for exhibition of art objects, paintings, illustrations and sculpture.

History museum deals with specialized aspects of history. May include archaeological material. It collects and exhibits material from an ethnographic viewpoint. Emphasis is placed on culture rather than chronology in the presentation of the collections

An children's museum provides interactive exhibits and programs to stimulate informal learning experience for children.

An general museum hold collections in more than one subject and are therefore sometimes known as multidisciplinary or interdisciplinary museums.

- GENERAL
- ART
- HISTORY
- BIOGRAPHICAL
- CHILDREN'S
- ETHNOLOGY
- NATURAL HISTORY AND SCIENCE
- SCIENCE AND TECHNOLOGY
- ....Etc

Ethnological museum focus on studying, collecting, preserving and displaying artifacts and objects concerning ethnology and anthropology.

An biographical museum display items relating to the life of a single person or group of people and the items collected by their subjects during their lifetime.

Museums of science and technology are concerned with the development and application of scientific ideas and instrumentation

Museums of natural history and natural science are concerned with the natural world; their collections may contain specimens of birds, mammals, insects, plants, rocks, minerals, and fossils.

REF: https://www.britannica.com/topic/types-of-museums-398830

TYPES OF MUSEUMS :

Tate gallery, London

Kanazawa Bunko Museum, japan

Brooklyn Children's Museum

- GENERAL
- ART
- HISTORY
- BIOGRAPHICAL
- CHILDREN'S
- ETHNOLOGY
- NATURAL HISTORY AND SCIENCE
- SCIENCE AND TECHNOLOGY ....Etc.

National museum of history ,in Chapultepec Castle, Mexico City

Fryderyk Chopin Museum

Vietnam Museum of Ethnology, Hanoi

Deutsches Museum in Munich

Natural History Museum in London

CULTURAL ASPECTS :

HISTORY OF DURGAM CHERUVU :

- Secret lake popularly known as DURGAM CHERUVU is spread over an area of 63 acre and is surrounded by hills of the Deccan Plateau.
- The rocks found near Durgam Cheruvu are extremely unique and are 2500 million years old granite rocks, the only one in all of Asia.
- The girdle of rocks surrounding the lake is the first Heritage Precinct to have been notified under HUDA Heritage regulations.
- Hyderabad is the only city that has legally protected rock formations in the country
- It is said that the lake was used as the source of drinking water for the Golconda Fort. Also called as the 'Madhapur Lake.

REF: https://vedasri.wordpress.com/2012/09/22/evolution-of-hyderabads-architecture/

THE CURRENT SCENARIO :

The Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB) is to lay a sewerage pipeline around the lake right next to the water from Inorbit mall along the shore up to the old bund of the lake for which 'protected' granite rock slabs are to be cut which is against the HMDA regulations

EVOLUTION OF MUSEUMS :

The architectural design of the museums is the ability to create a special and an inspiring envelop which provides its visitors with different experiences, according to its cultural message.

MUSEUMS OF ANCIENT TIME (B.C)

- Under the Egyptian dynasty Pharaoh Akhenaton had built a library to preserve antiques and precious collections.

MUSEUMS OF THE MEDIEVAL (5TH - 15TH CENTURY)

- With the spread of Christianity in Europe, the art collections were mainly preserved in Princess's palace or in the churches and were used economically by funding arms during the war and for trading purposes.

MUSEUMS OF RENAISSANCE (15TH - 17TH CENTURY)

- The Passion of collecting antiques has increased and spread all over the European countries.
- Started by king Matthias I in Hungary followed by Frances II in France, Charles V in Spain, Charles I in England.

MUSEUMS OF THE LATE 17TH CENTURY

- At the end of 17th century the nobles and royals started keeping their collections in "Cabinet of Antiques" which contained paintings, antiques and some pieces of natural history.
- All these Palaces where later converted into museums officially. ex: Louver Palace was turned into Louver museum by Louis xiv to present is royal collection.

MUSEUMS OF 18th CENTURY

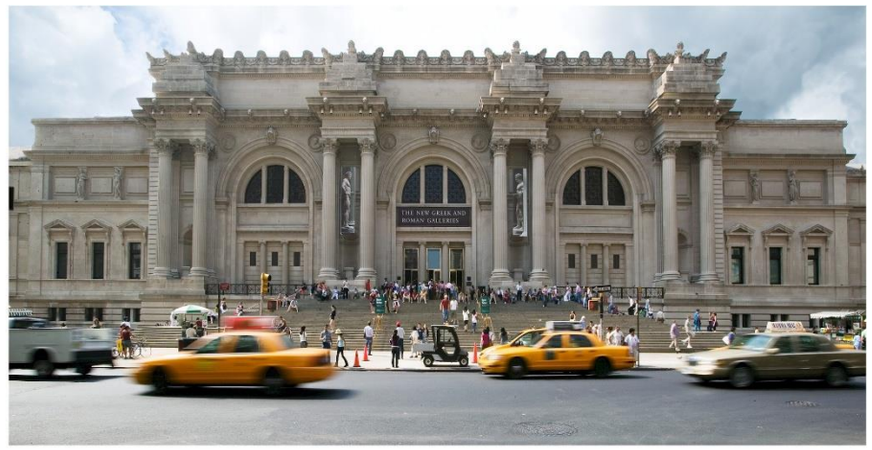
- The public interest for art and culture became higher after the industrial revolution. Museums were for aristocratic class but were opened for few days for public.
- New museums such as British Museum in London and Louvre museum in Paris had been built.
- In the 18th century museum building architecture was as follows:
- The museum was with the cross shape plan, with a dome in the center surrounded by exhibition halls covered by vaults.
- They used solid elevations in case of using top lighting. The main elevation was full of column, natural forms, with big entrance.
- The light source was always from the natural light by top lighting, so they used the clear story lights, and large numbers and areas of windows in the elevations to get the maximum advantage of the natural light.

MUSEUMS OF 19TH CENTURY

- After French Revolution, French Campaign on Egypt and Damadcus was returned with Egyptian artefacts which lead to the new museums and more palaces turned into museums.

Louver Palace

British museum



Metropolitan museum

MUSEUMS OF 20TH CENTURY

- After the Three Russian revolutions, new museums had been established to glorify these.
- Adopting a different ideology of the new architectural pioneers which had effected the design concept of museums to be different from the past.
- New scientific and Technological progress resulted in new types of museums: science and technology, anthropology and ethnology, archaeology, arts and natural history.

MUSEUMS OF 21ST CENTURY

- New functional spaces have been added:
- Preservation and restoration rooms: labs and workshops
- Educational and cultural spaces: library, lecture hall, showrooms and conference halls
- Entertainment spaces: restaurants, cafeterias, and stores for gifts and souvenirs.
- The shift to the digital design technology offered the architects new solutions for their problems. the new technology provided new ways of presenting artefacts, lighting techniques and virtual visits for the museums.

The Winter palace

The London science museum

The Denver museum

EVOLUTION OF HYDERABAD'S ARCHITECTURE:

- Architecture is quite literally the face of a civilization; it largely depends on cultural, technological and economic imprints.
- Different rulers build differently, at times merging completely diverse techniques to create a new style and different time frames bring about whole different meanings to buildings of their eras.

PERIOD	TYPE OF CONSTRUCTION
1. MAURYAN EMPIRE	MOSTLY BUILT WITH BAMBOO STICKS, DRIED LEAVES, AND MUD.
2. QUTUB SHAH'S DYNASTY (ISLAMIC STYLE)	▪ DIFFERENT FROM ISLAMIC ARCHITECTURE SEEN IN NORTHERN INDIA. ▪ARCHITECTURAL STYLES WERE LARGELY MOULDED ON THE WESTERN LINES WITH MUGHAL IDEALS. ▪IT GAVE RISE TO A COMPLETELY NEW STYLE IN FORM, CALLED INDO-SARCENIC OR INDO-PERSIAN. ▪EX: GOLCONDA FORT, CHARMINAR, QUTUB SHAHI TOMBS
3. AURANGZEB'S REIGN (NIZAM'S)	▪MOSTLY PATRONISED ISLAMIC ARCHITECTURE, CULTURE AND THE INDO-PERSIAN STYLE WAS HUGELY EMPLOYED. ▪THEY WERE INSPIRED WITH THE BRITISH ARCHITECTURAL STYLE (WOOD, BRICK STONE, LIME MORTAR WERE USED)

CHOWMAHALLA PALACE

DURING NIZAM'S PERIOD

GOLCONDA FORT

DURING QUTUB SHAH'S DYNASTY

- When the Nizam signed into the Indian Union and Hyderabad was to be made a state capital, the need for an infrastructure was sufficed through new public buildings.
- Concrete, was then new and an increasingly important building material. Most of the buildings made of concrete slabs and frames were skinned with brick and painted or clad with stone.
- After a couple of decades of steadily brewing architecture scene globalisation came knocking. The potentials are manifested as tech parks, estates and huge multinational offices.
- Concrete, brick and glass were the materials which were in common use.

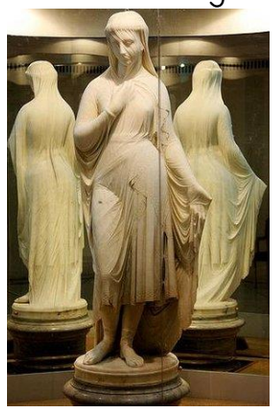
Salar Jung museum :

Introduction :

- The museum is one of the top three National Museums of India .
- It has a collection of sculptures, paintings, carvings, textiles, manuscripts, ceramics, metallic artefacts, carpets, clocks, and furniture from Japan , China , Burma , Nepal , India , Persia, Egypt ,Europe , and North America .
- The museum's collection was sourced from the property of the Salar Jung family. It is one of the largest museums in the world.

Location:

The present museum building was constructed on the southern bank of River Musi, which is in close proximity to the important monuments of old city of Hyderabad like the historic Charminar, Mecca Masjid etc.



Brief history and evolution of the museum :

- The major portion of this collection was acquired by Nizam Mir Yousuf Ali Khan popularly known as Salar Jung III.
- The zeal for acquiring art objects continued as a family tradition for three generations of Salar Jungs.
- In 1914, Salar Jung III, after having relinquished the post of Prime Minister to H.E.H., the Nizam VII, Nawab Mir Osman Ali Khan, devoted rest of his entire life in collecting and enriching the treasures of art and literature till he lived.
- The precious and rare art objects collected by him for a period of over forty years, find place in the portals of the Salar Jung Museum, as rare to very rare pieces of art
- With a view to perpetuate the name of Salar Jung as a world renowned art connoisseur, the Salar Jung Museum was brought in to existence and was opened to the public by Pandit Jawaharlal Nehru, the then Prime Minister of India on 16th December, 1951
- The collections of the Museum and the library were transferred from Dewan Deodi to the new building in the year 1968, and two more buildings were added in the year 2000

Telangana State Archaeology Museum :

location :

located in public garden, Hyderabad, India.

History :

- In 1930, VII Mir Osman Ail Khan, wanted to preserve the Hyderabad's state's heritage, had named the museum as Hyderabad Museum.
- The Museum was formally inaugurated in the year 1931
- It was named as Andhra Pradesh State Archaeology Museum in 1960.
- The Hyderabad Museum was subsequently renamed, as the State Museum under the Department of Archaeology & Museums.

Introduction :

- Also called Hyderabad Museum.
- one of the richest repositories of antiquities and art objects in the country and is the oldest museum in Hyderabad state .
- The present Museum building reflects the Indo-Islamic architecture with subtle domes, high arches, stylistic windows and projected eves.
- By nature, the museum has remained mainly research-oriented, bringing out several publications about its varied collection

COLLECTION :

- This museum's main attraction is its Egyptian mummy, which was brought to Hyderabad by the son-in-law of VI Nizam Mahbub Ali Khan, and donated to the last Nizam Mir Osman Ali Khan.
- A huge gallery on Buddha dating back to last century. The museum has a wide variety of archaeological artifacts from the Nizam,Kakatiya dynasty.
- From 1950 on, the museum started collecting works of contemporary artists and, in 1968, its name was changed to the AP State Museum and administered by the state government of Telangana.
- There are many galleries devoted to stone sculptures, bronze works, manuscripts, modern paintings, and textiles, among others.
- The collection is spread across two floors of the heritage building, two floors of semi circular galleries, in a separate contemporary art pavilion building and in an annex building located behind.

POLITICAL AND SOCIAL AMBIENCE

- In last 15 years, Hyderabad emerged as IT and Pharma hub of India
- After the formation of the Telangana state, the government claims to safeguard its rich culture along with a larger Vision to make Hyderabad as a Global Smart City meeting the long term needs of the city.

❑ Proposed projects:

- Ccc twin towers
- High rise buildings all around Hussain sagar
- Secretariat
- Multi level flyovers

Command and Control Centre Twin Towers

- Twin towers of 16 floors and 24 floors and helipads atop, with a skywalk connecting them is a world class Command and Control Centre for the state.
- The one lakh surveillance cameras to be installed in the city with public-private participation and police headquarters of all the districts would be synchronised with the CCC.
- Hoping that the twin towers would be icon building for the city, the Chief Minister directed officials to construct it at the eight acres allocated to Hyderabad police Commissionerate.
- It has an auditorium with seating capacity for 1,000 persons.
- The twin towers would have four lakh square feet of built up space.

Source:
http://www.thehindu.com/news/cities/Hyderabad/twin-towers-to-house-police-command centre/article7466052.ece
published on July 26th 2016

Hussain Sagar Lake with Skyscrapers

- The surroundings of Hussain Sagar are all set to be dotted with skyscrapers.
- The surroundings of Hussain Sagar might all likely to be glittering with towers of 60-100 floors. These towers would house government offices, commercial complexes and also entertainment zones.
- Rao said his government has grand plans to develop Hyderabad on par with international standards, and skyscrapers and high-rise towers are a part of it.
- "There are several advantages of skyscrapers. Using minimum land, various facilities can be provided. They can house government offices, commercial complexes and also entertainment zones," Rao opined and said the Petronas Towers in Kaulalampur in Malaysia and the ones on the shores of Mumbai are best examples. Five star hotels and tourist rest houses can also come up in these towers.
- Environmentalists also argue that there is more at stake here than just heritage.

Source: By Express News Service
Published: 13th November 2014
http://www.newindianexpress.com/states/telangana/KCR-Plans-Big-to-Garland-Hussainsagar-Lake-with-Skyscrapers/2014/11/13/article2520778.ece

NEW SECRETERIAT

- The Telangana new Secretariat Building design submitted by noted architect Hafeez Contractor has apparently been approved by the Chief Minister K ChandraShekar Rao.
- The government of Telangana is keeping open its options of going for a new Secretariat buildings complex even after its initial plans to have the complex on the premises of Chest Hospital at Erragadda first and, then, on the defence land at Bison Polo Grounds in Cantonment area in Secunderabad later hit the roadblock for various reasons.
- The U shaped design comprises five new blocks with five floors each. The CMO block will be built in the existing location, surrounded by two blocks on either side. The century-old G-Block in the Secretariat, which has survived several demolition attempts earlier due to resistance from heritage lovers, is set to be razed soon to pave the way for construction of the new Telangana Secretariat.

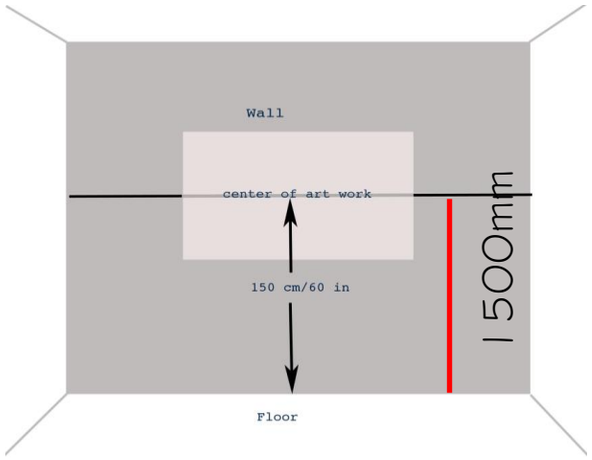
Source:
https://www.telanganastateinfo.com/telangana-new-secretariat-building-design-plan-images/

DISPLAY AREA & SPACE REQUIREMENTS

CONTENTS

DISPLAY AREA

- A set of showcases, freely positioned in space, with or without special air-conditioning, may be used.
- The showcases should be arranged in such a way as not to be directly exposed to the sun.
- Similarly, when artificial lighting is used, steps must be taken to prevent heat being given off inside.
- Continuous mural showcases, large sections of the exhibition area insulated by means of glass panels going right up to the ceiling and provided with separate air-conditioning, may be used.
- The showcases are usually built against the walls but may also be positioned in such a way as to be approachable on all sides.

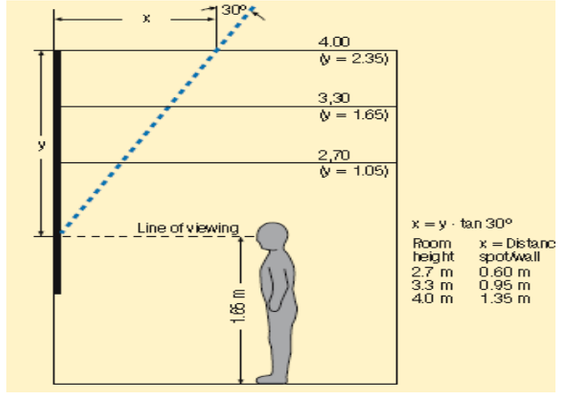


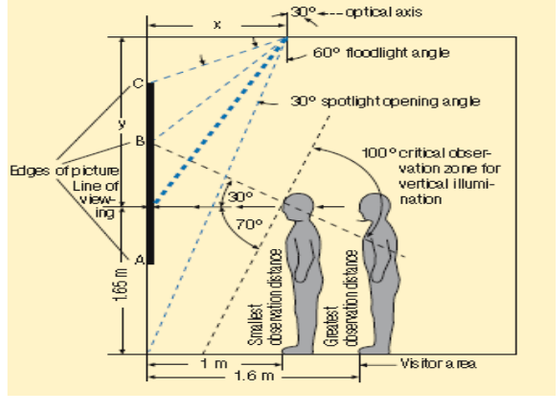
Object display	Min height FFL mm	Max height FFL mm
General – Viewing band	700	2000
Small objects – Viewing band	800	1600
Very small items – Viewing band	800	1015
Wall mounted items over 1000mm deep	600	2030
Ceiling hung items	600	2400
Protective zone (arm's length)	305	N/A

PAINTINGS & PHOTOGRAPHS

- Paintings, drawings and similar objects must be secured to the walls by mirror plates or security screws.
- Unglazed paintings, fragile/sensitive material or works/objects on open display must be protected by rope or other barriers, which must be at least 1 metre from the exhibits.
- Height of ceiling in display area 4m is adequate.

REFERENCE:
https://www.britishcouncil.in/sites/default/files/guidelines_for_**museum_display**.pdf





SCULPTURES

- Recommended distance to place objects out of 'casual arm's length' taken from the edge of the object to the edge of any proposed form of barrier- 600mm minimum.

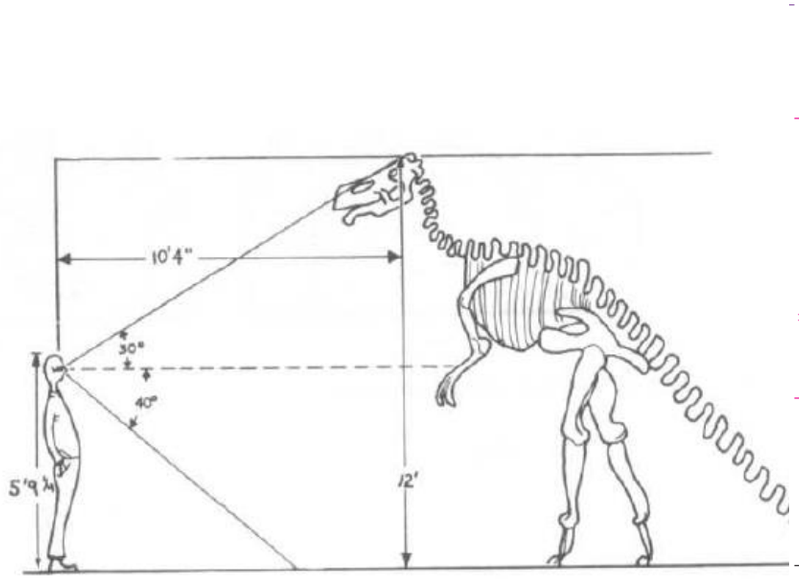
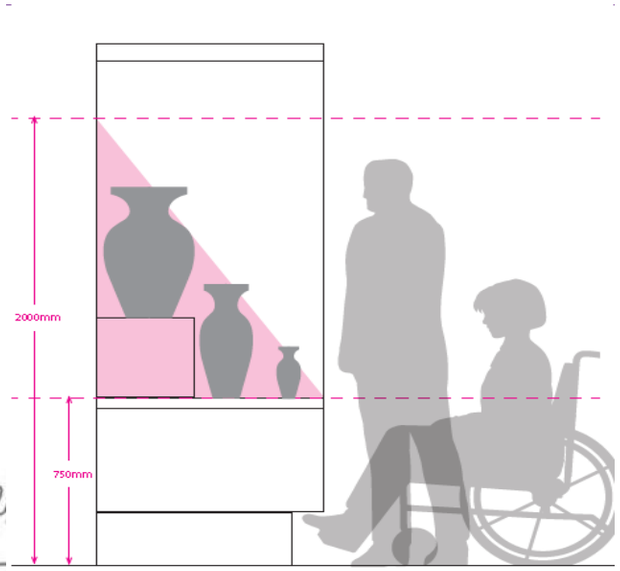
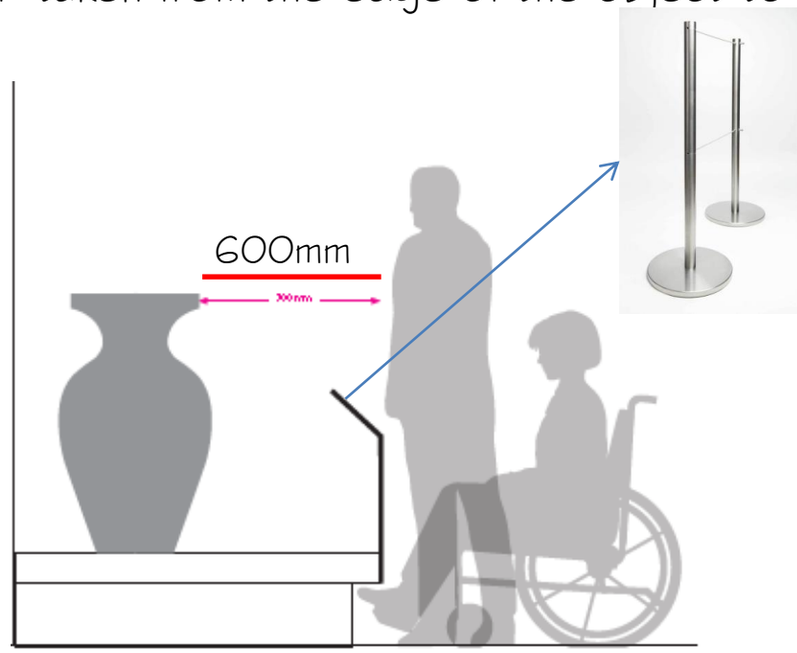


Fig. 6 Viewing distance should increase with greater size of object.





height of ceiling in display area for sculptures may be in excess of 13m.

JEWELLERY & CLOTHING

- All cased displays should fall within the general optimum viewing band of 750–2000mm.
- Desk cases should be no higher than 800mm FFL.
- Provide a toe space of 230mm x 180mm deep around cases and plinths to allow wheelchair access.
- Position small items or those with fine detail no higher than 1015mm from floor level.

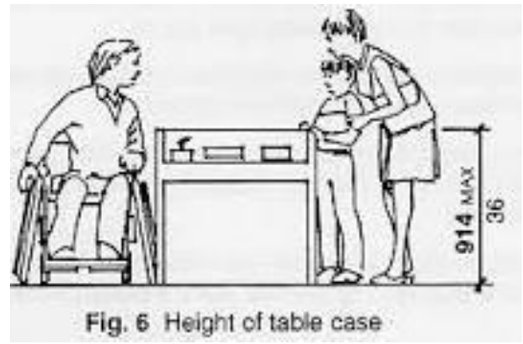
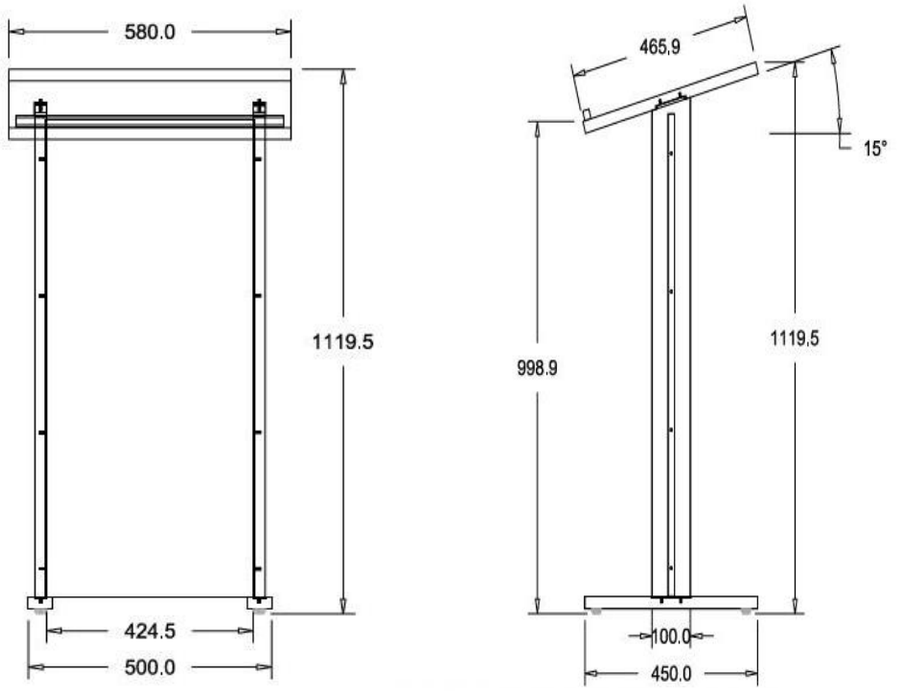


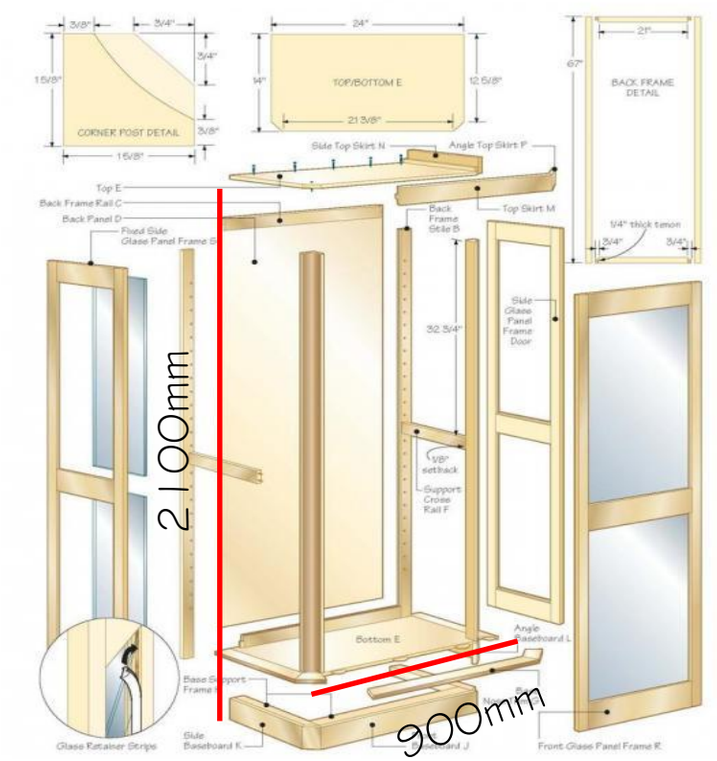
Fig. 6 Height of table case

REFERENCE: https://www.britishcouncil.in/sites/default/files/guidelines_for_**museum_display**.pdf

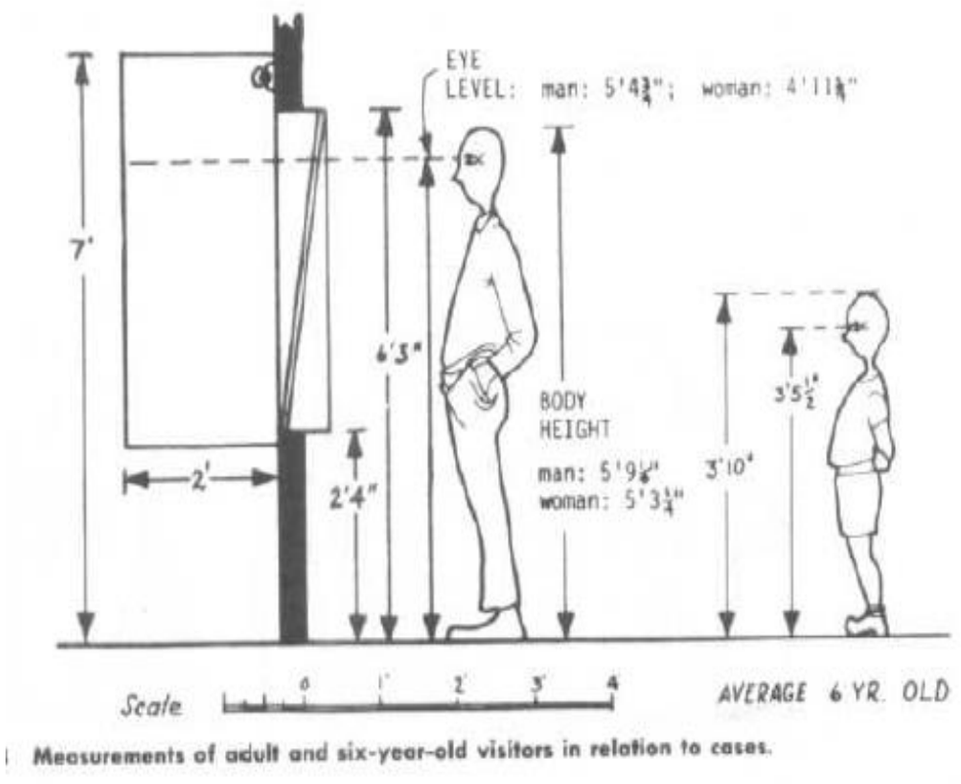
Manual of Museum Exhibitions edited by Barry Lord, Maria Piacente

- A **curio** (or **curio cabinet**) is used to display collections of artefacts, clothing.
- Most curios have glass on each side, or possibly a mirror at the back, and glass shelves to show the entire figurine.





OBJECT DISPLAY FOR CHILDREN

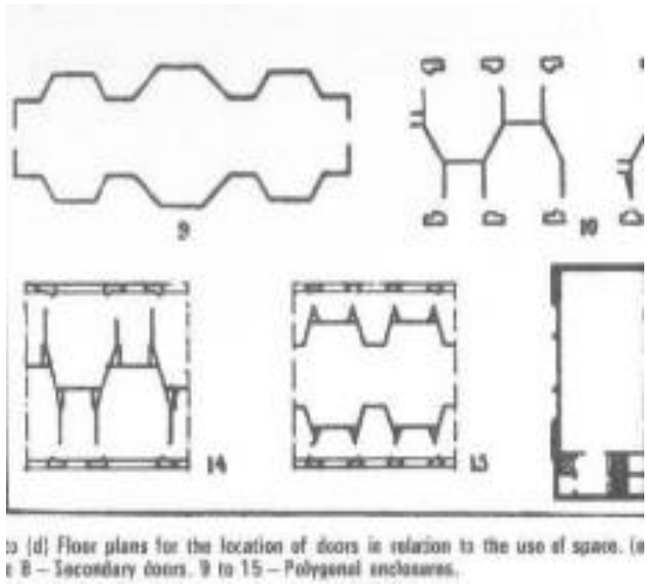


Measurements of adult and six-year-old visitors in relation to cases.

These are the recommended measurements for developing child-orientated displays.

Average eye height	Height standing from FFL mm	Height sitting from FFL mm
Under 5s	700–1075	700–865
5–12	1010–1475	865–950
Average reach	Standing	Sitting
Under 5s	430–580	360–490
5–12	545–880	410–705

Wall and screen mounted interpretation optimum viewing bands for information	Min height FFL mm	Max height FFL mm
Graphic panels	700	1075
Screen based interpretation – NB glare at child height falls between 1000–1060mm	700	1075
Optimum centring level	Height FFL mm	
Panels	1400	
Labels	1225	



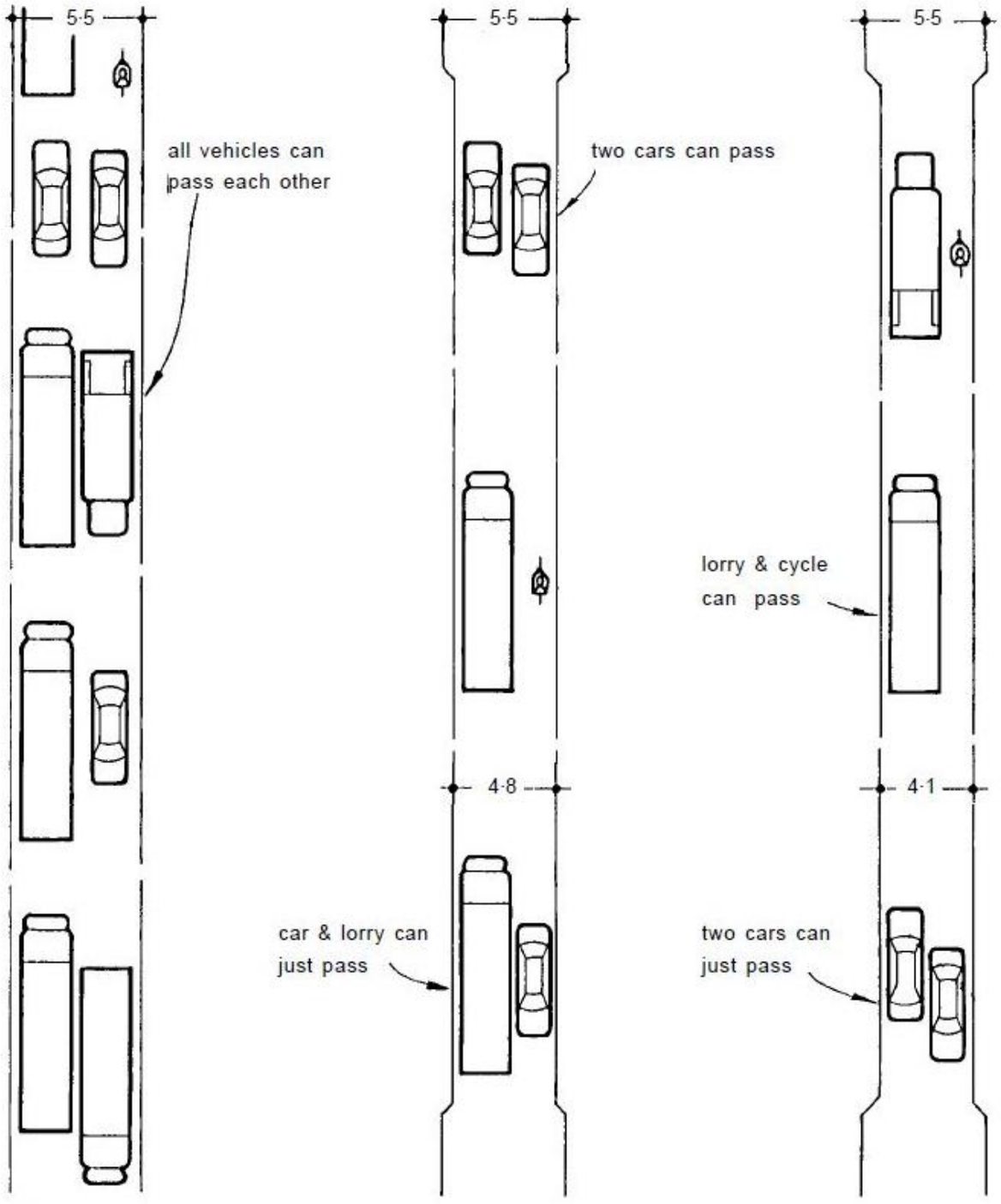
Arrangement of objects in display area

PARKING

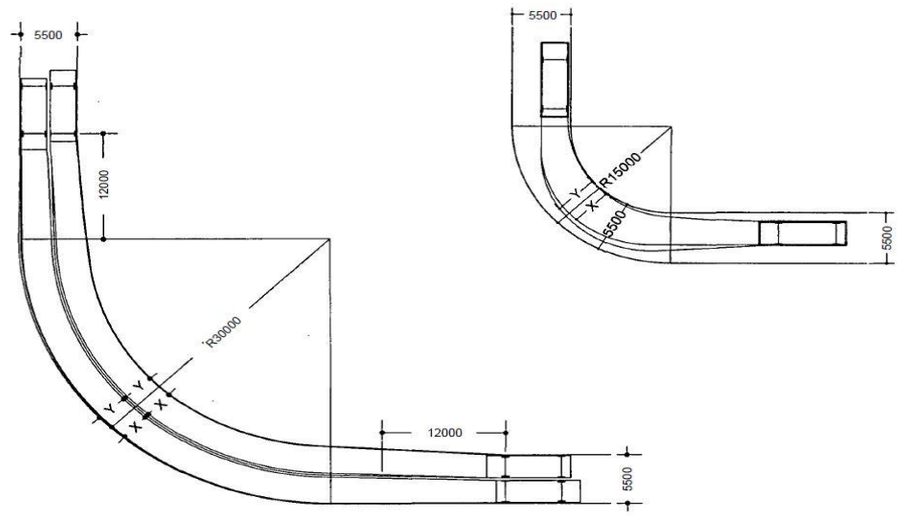
- Entries
- Services and security
- Approach to parking
- Walkway from parking
- Entrance to lobby

Many security problems can be avoided by keeping the number of access points to the site and to the building to a minimum.
Such as

- service entry
- staff entry
- loading and docking
- main entry
- entry to the parking



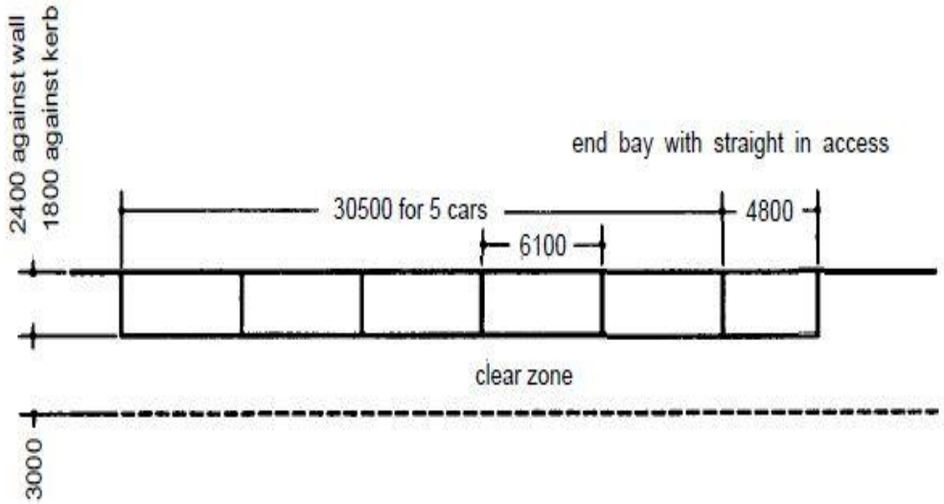
4.5 *Characteristics of various carriageway widths on two-way roads*



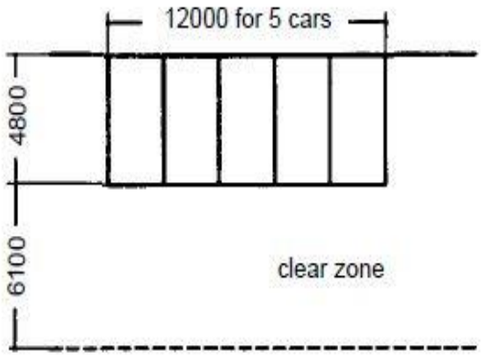
- Minimum of 2-line way
- Turning radius of 5m-12m
- Clearance height of minimum -4m
- when a vehicle travels round a curve the road width it occupies is greater than the track width on.

Type of building	Car parking provision	Loading/unloading provision	Cycle parking
Museums and public art galleries	Staff: one space per two members normally on duty Visitors: one space per 30 m^2 of public display space	Minimum 50 m^2	1 per 300 m^2 minimum 4

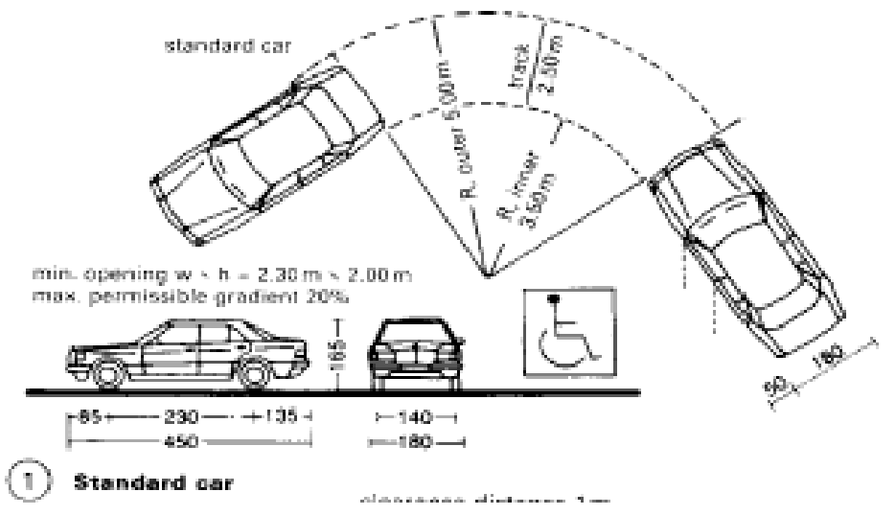
4.37 *Basic parking dimensions. Standard European parking bay or stall 4.8 × 2.4, allow 24 m^2 per car, including half the clear zone but no access gangways*



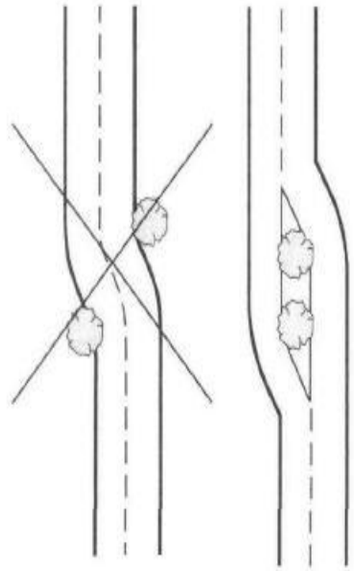
b *echelon parking at 45° (other angles can be used): 22.1 m^2 per car or 19.2 m^2 where interlocking in adjacent rows*



c *head-on parking, 18.8 m^2 per car*

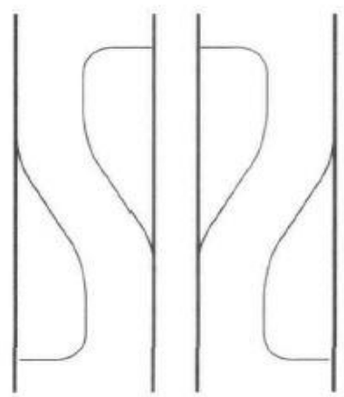


① **Standard car**



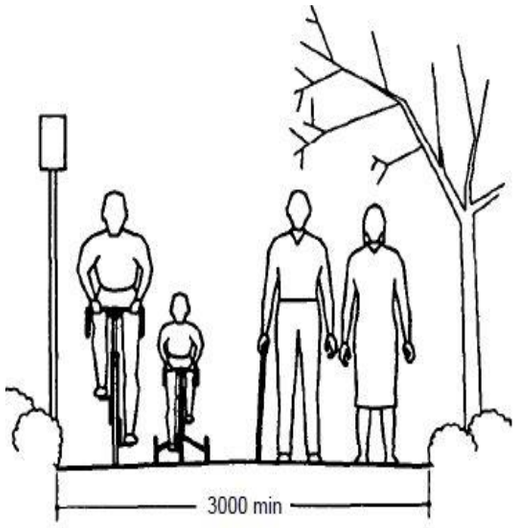
chicane with inadequate lateral shift ('racing line' possible)

chicane with 'racing line' prevented by divided carriageway

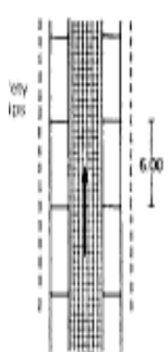


PARKING SPACE REQUIREMENTS:

TYPES OF VEHICLES	PARKING ANGLE	STALL LENGTH (MTS)	STALL WIDTH (MTS)	AISLE (MTS)	PARKING DEPTH (mts)	AREA IN SQM
Car	90	3.52	2.25	6	4.5	21.42
Auto	90	2.59	1.83	2.13	3.66	7.7
Scooter	90	2.32	1.2	1.38	2.58	4.4
Rickshaw	90	2.79	1.52	2.13	3.81	5.79
Bicycle	90	2.15	1.37	1.37	1.98	2.14



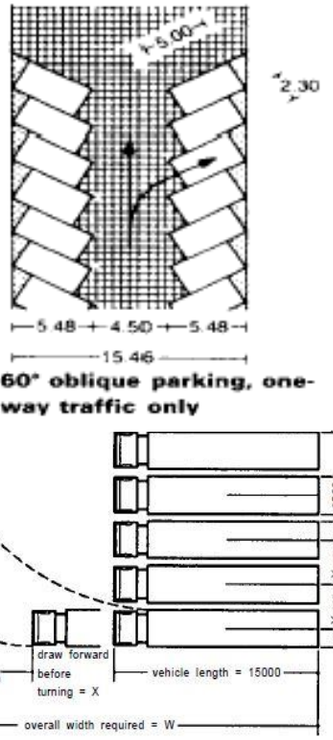
4.22 *Cycle path shared with pedestrians*



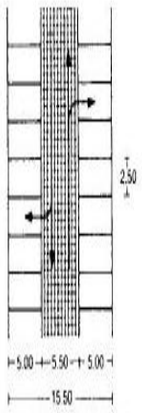
Parking parallel to the road

② 30° oblique spaces, easy entry and exit, but for use only with one-way traffic

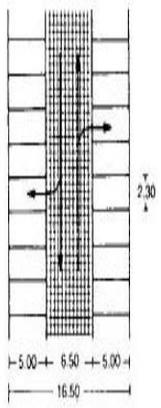
③ 45° oblique parking, one-way traffic only



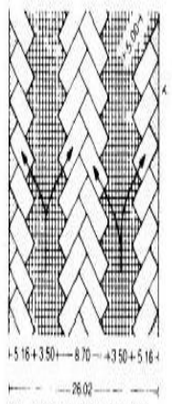
60° oblique parking, one-way traffic only



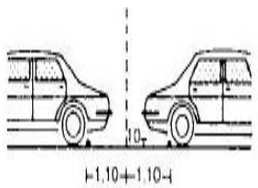
① 90° entry/exit to parking spaces for two-way traffic Parking space 2.50 m wide

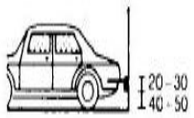


⑥ 90° entry/exit to parking spaces, for two-way traffic Parking space 2.30 m wide



⑦ 45°-angled parking, one-way traffic only





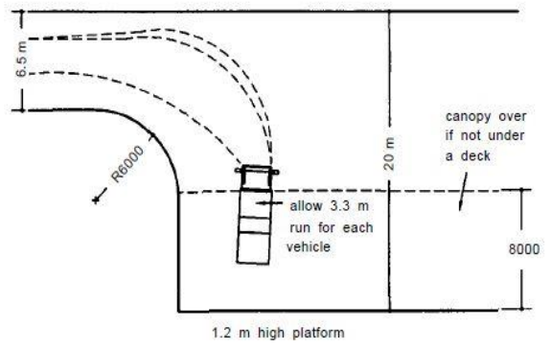
⑬ Stop rails and buffers

X draw forward	Y centres	W o/a width	L o/a length for 5	Area per vehicle (m^2)
1	5.0	27.4	22.5	123
2	4.4	28.4	20.1	114
3	4.0	29.4	18.5	109
4	3.7	30.4	17.3	105
5	3.4	31.4	16.1	101
6	3.0	32.4	14.5	94

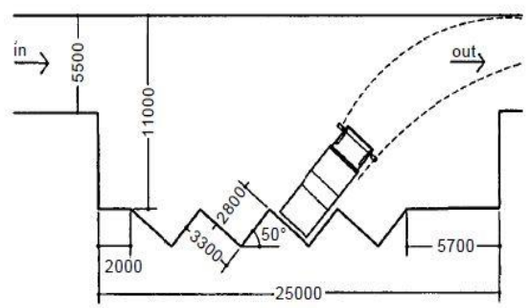
4.40 *Lorry parking and loading bays: head-on for the largest vehicles*

8 LOADING AND UNLOADING

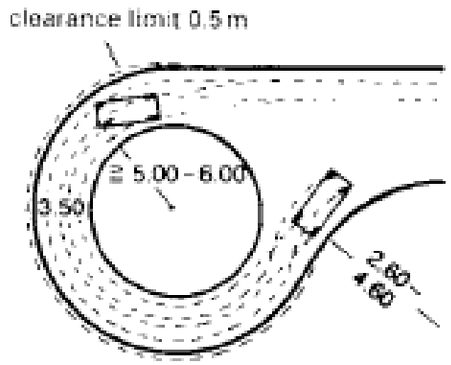
4.40 to **4.45** show requirements for loading, unloading and parking large vehicles.



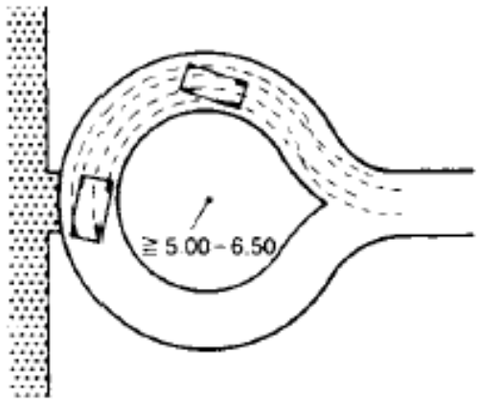
1.2 m high platform



•Parking stalls should be built to accommodate larger cars.
•The larger cars have an over-all length of 5.7m,over-all width of 2.5m.
•Ramp angle must not exceed 7
•Limit of front approach angle is 14.



2) **Car turning circle**



3) **Car turning circle radius for an entrance drive ≥ 5–6.50 m**

TYPES	NO. OF VEHICLES
Cars	4.5% of the total capacity
Scooters	10% of the total capacity
Cycles	25% of the total capacity

VEHICULAR DIMENSIONS

TYPES	LENGTH(m)	WIDTH(m)
Cars	4.35	1.65
Auto	2.44	1.37
Scooters	2.03	1.06
Motor cycle	2.09	1.06
Cycle rickshaw	2.59	1.19
Bicycle	1.91	0.53

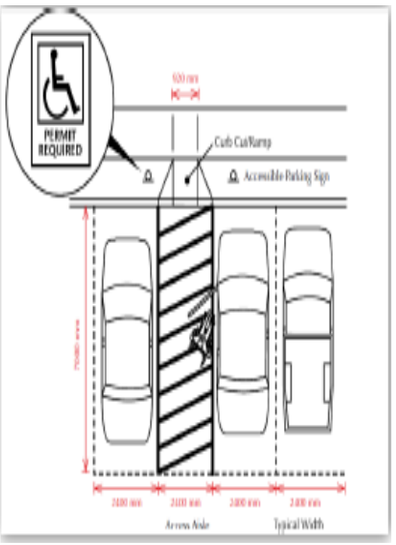
BARRIER-FREE

•Surface parking for two car spaces shall be provided near entrance for physically handicapped persons wit max.travel distance of 30m from building entrance.
•Guiding floor materials shall be provided
•Width of parking bay shall be min. of 3.6m.

Parking and Drop-Off Areas

Provide a minimum number of barrier-free car parking spaces in each parking area as follows:

Total parking spaces provided	Minimum barrier-free car spaces required
1 - 10	1
11 - 20	2
21 - 50	3
51 - 75	4
76 - 100	5
101 - 200	6
over 200	1 additional for each additional 100 spaces or part thereof



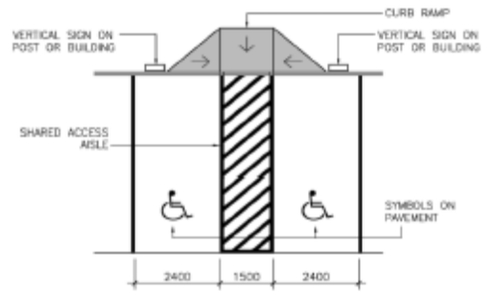
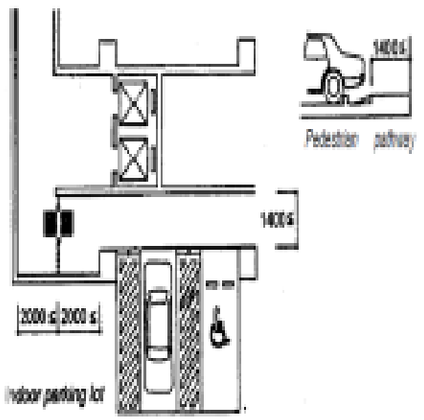


Figure 1 Barrier-Free Car Parking Spaces



DISPLAY AREA SPACE REQUIREMENTS		
DISPLAY CATEGORY	ARTICLES UNDER DISPLAY	PERCENTAGE OF TOTAL DISPLAY AREA
HISTORY OF TELANGANA (FORMATION) RELIGION FESTIVALS LANGUAGES CUISINE	MANUSCRIPTS PHOTOGRAPHS	8%
LITERATURE	MANUSCRIPTS BOOKS DOCUMENTS	10%
CLOTHING	CLOTHES	5%
ARCHITECTURE	MODELS PHOTOGRAPHS	15%
SCULPTURES	SCULPTURES	15%
PAINTINGS	PAINTINGS	15%
NUMISMATICS	COINS	4%
JEWELLERY	JEWELLERY	8%
WEAPONS	WEAPONS	5%
PERFORMING ARTS DANCE MUSIC SHADOW PUPPET SHOW	MUSICAL INSTRUMENTS INTERACTIVE DIGITAL MEDIA AV ROOM	15%
TOTAL DISPLAY AREA / PERSON - 2.8 TO 4.6 m2 (CONSIDERING THE PEAK HOUR FLOW AS 500) (SOURCE: The Engaging Museum: Developing Museums for Visitor Involvement-By Graham Black)		

SPACE	PEOPLE	AREA/PERSON (SQM)	REMARKS
SECURITY (24X7)	4	4	-
TICKET COUNTER	2	2	-
HELP DESK	2	3	-
CAFETERIA	50	2	-
STORAGE	-	-	200 SQM (MIN)
OPEN AIR THEATRE	300	1.5	-
RESEARCH CUBICLES	-	5.0 – 10.0	-
AV ROOM	250	2	-
LIBRARY	10	2	-
WORKSHOP AREA	50	2	-
INFORMAL PUBLIC GATHERING SPACE	-	0.5	-
DISPLAY AREA	IN THE PREVIOUS TABLE		
LOADING/UNLOADING	-	-	50 SQM (MIN) 5m height clearance
DIRECTOR'S OFFICE	1	14	-
CONFERENCE ROOM	-	2.5	-
CURATORIAL OFFICES	4	9.3	-
OPEN WORK STATION	5	6.0	-

USER GROUP AND BEHAVIORAL STUDY

It is in Vitruvius' words "Architecture is the art that combines **utilitas, firmitas, venustas, technology** and **beauty.** Not only the objects of architecture are important but also their 'audience'."

PURPOSE OF THE STUDY

- THE STUDY OF USER GROUP AND BEHAVIOR IS VERY IMPORTANT CRITERIA FOR BUILDING DESIGN, WHICH IS OFTEN OVERLOOKED.
- THIS STUDY HELPS BETTER IN UNDERSTANDING HUMAN INTERESTS, AND RESULTS IN A DESIGN MORE CUSTOMISED TO ITS USER AS IT WAS ORIGINALLY INTENDED.
- HERE, THE VARIOUS ASPECTS OF THE TOPIC ARE COVERED, RELATED TO MUSEUM AND OTHER GALLERY SPACES.

CONTENTS

DIFFERENT USER GROUPS

The different user groups expected and considered while designing a museum are:

- Age
- Gender
- Purpose/ Interest
- Size
- Ability
- Life stage
- Visitors
- First timers
- Researchers
- Non- Visitors

DEMOGRAPHICS BY MUSEUM TYPE

- Art museums and historic museums primarily draw adult audiences. And children's museums and science centers primarily draw family audiences.
- Also the aesthetical and technological aspects of museums attract different age groups.
- (note- age of 50 is considered as the draw line.)
- Visitors to museums and galleries tend to be from the higher socio-economic groups.

REF: (http://reachadvisors.typepad.com/museum_audience_insight/2010/04/whos-coming-to-your-museum-demographics-by-museum-type.html)

- The table below shows the proportion, who have visited museum in a year. (Mintel 2006).
- Ages from 35 to 45 have the highest attendance and followed by the age groups above 55.
- Age groups above 65 don't seem to visit much.

% All adults visited attraction	Museum / art gallery %
All	23
Age	
15-19	19
20-24	21
25-34	23
35-44	31
45-54	22
55-64	25
65+	15

Based on their lifestyle, percentage of people who attend, etc. are:

Lifestage	
Pre-/no family	27
Family	24
Empty nest	23
Retired	15

REF: (http://webarchive.nationalarchives.gov.uk/20120215211132/research.mla.gov.uk/evidence/documents/audience%20knowledge%20digest.pdf)

AGE

Ages 16+ are considered for a general museum.
Classified into teenagers, adults, elderly.
Various types of museums attract different age groups.
This factor also decides the accessibility to rest areas, toilets and other circulation.

GENDER

Females tend to visit museums and art galleries more than male in the age group 30-50.
Male cover more area (footpace) than female while walking.

PURPOSE

Hierarchy of motivations-
Spiritual 3%, emotional 11%, intellectual 38%, recreational 48%.
For art galleries social motivational is lesser and the spiritual motivational reasons increase.
Only 20% of the total visitors of a day may be re visiting , all others are generally first timers.

SIZE OF THE GROUP

Family visitors are more, with children.
School children visit in groups.
Group of 2-3 is common in the age groups 20-30.

ABILITY

Different age groups have different walking speeds and capacities.
Usage of the rest areas depends on various factors- age, waiting or satiation.
Also disability locomotion should be considered.
WALKING SPEEDS
Average constant speed generally assumed in museums is 3km/h with hovering speed 1 km/h.

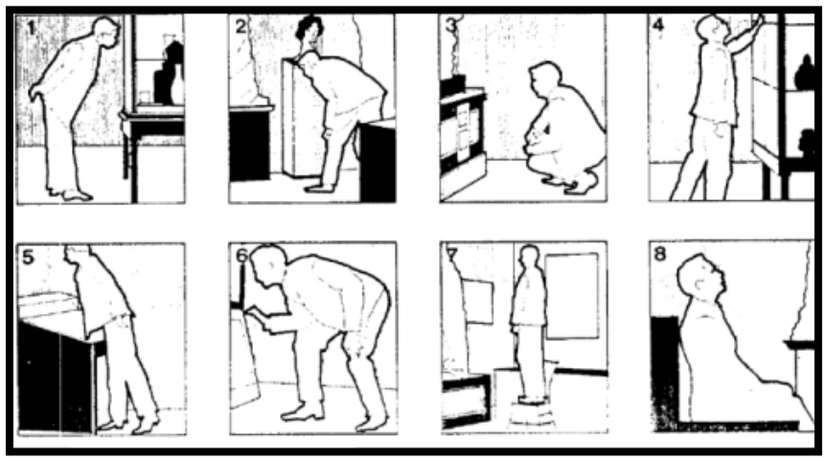
REF: http://ceur-ws.org/Vol-756/paper07.pdf

HUMAN COMFORT, SAFETY, AND ACCESSIBILITY

Make the transition from being a warehouse of cultural relics to being a genuine public service and educational facility.

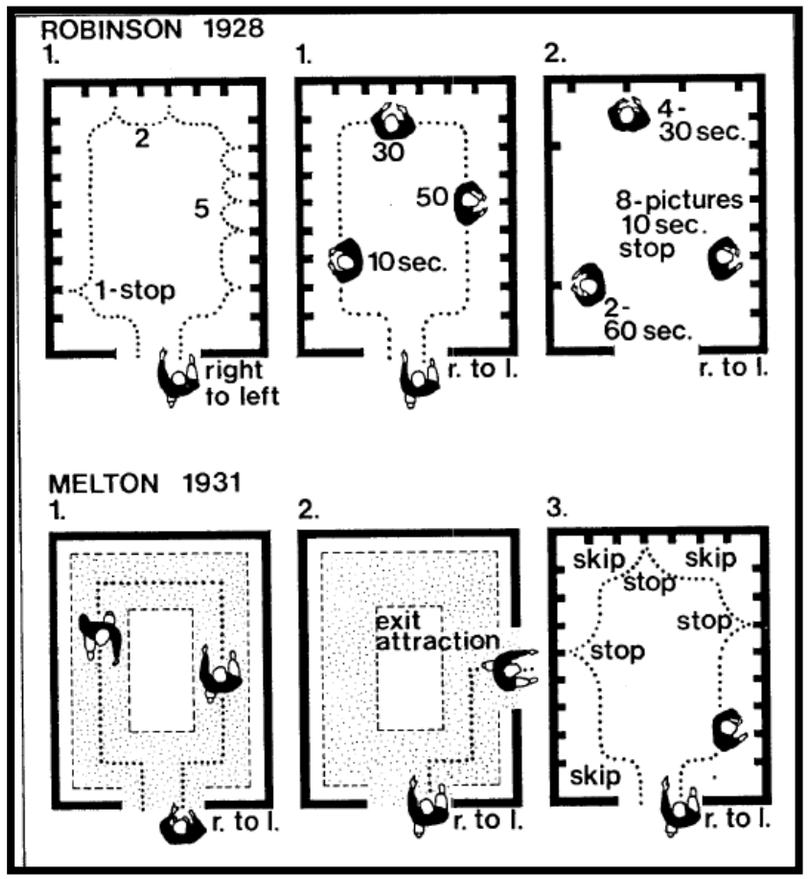
Some specific ways are-

- The physical space (layout, lighting, flooring) - for all human sizes.
- The content – for all cultures.
- The environment – adaptive for all ages.



Results of behavior mapping
By Benjamin Gilman

Difficult human postures
Bent, crouching, stretching up, climbing up, looking up.



It is important to maintain a balance between the building, visitors and the exhibits

CHARACTERISTICS OF MUSEUM VISITORS-

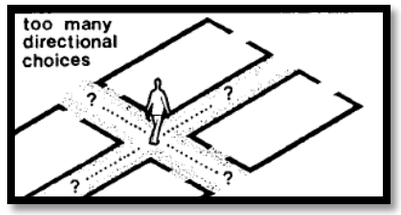
- Most visitors come as family, friends, guided tour, or school group
- Building components. [doors, colors, room sizes, and locations] effect the use of gallery space.
- People observe other people's behavior and pick up non-verbal clues about what to do.

REF: Visitor characteristics

- http://dc.uwm.edu/caupr_mono/16/
- http://www.emuzeum.cz/admin/clanky/files/194-EXStandards.pdf
- http://www.aam-us.org/docs/default-source/accreditation/committee-on-education.pdf?sfvrsn=0

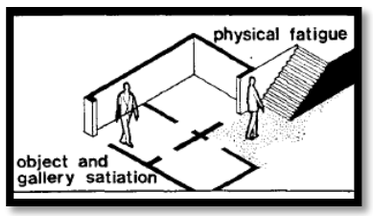
ORIENTATION-

Integrated approach maps and signs
Handouts for orientation aids



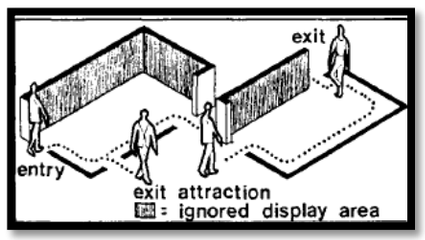
MUSEUM FATIGUE-

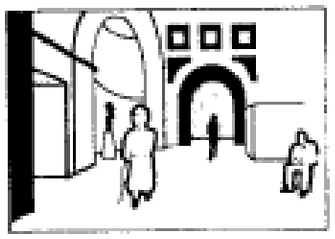
Gallery satiation, body postures,
rest areas



ROUTE SELECTION-

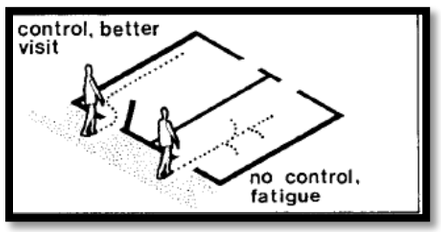
Exit attraction, walking habit (r to l),





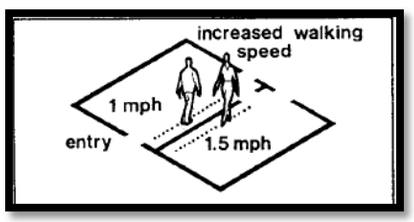
TRAFFIC FLOW-

Traffic coordinator for school groups,
Controlled flow without disruption



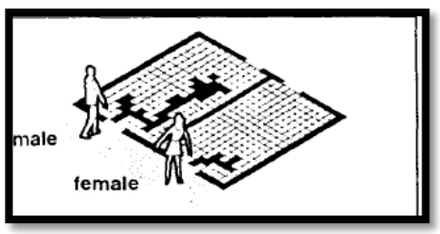
GALLERY SATIATION-

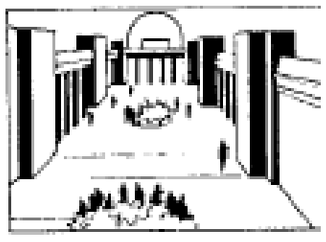
Lack of diversity and contrast



RANGE OF MOVEMENT-

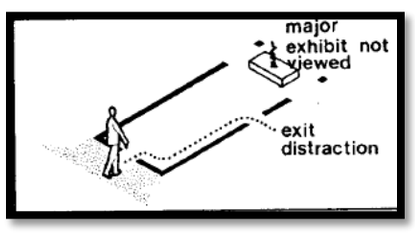
Dark walls, cover more area with an
exit, diversity display

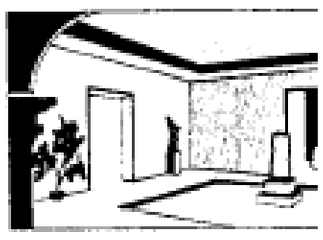




ATTENTION, DISTRACTIONS-

Exits, windows, lengthy walks





OTHER USERS

The different users of a museum are the visitors, janitors, curators, educators, administrators, security providers.

MAINTENANCE STAFF-

Operation of museum involves 3 functions :

- Managing daily operations
- Maintenance and repair
- Security

➢ JANITORIAL ROOM

- Housekeeping supplies & equipment such as mops ,brooms ,tools ,lawn mower ,snow blower , including sinks for wet mop activities.
- The janitors' closet and sink location not cause any disruption to visitors.
- Mobile shelving techniques.

➢ MAINTENANCE AND REPAIR

- Clear lines of demarcation must be drawn between building maintenance and collection care responsibilities, especially if there are open displays or large artefacts or specimens that are easily accessible to cleaners.
- Building exterior and interior maintenance be done daily, weakly, monthly and yearly.
- Maintaining strict temperature and humidity control to protect artwork and antiquities is an additional challenge.

SIZEOF STORAGE

- Equipment storage : 24 sq.M
- Maintenance block : 55 sq.M

MUSEUM ADMINISTRATION

- Museum administrators make choices, developing and executing plans so that museum collection can be preserved and museum visitors can have compelling experience with the artifacts and specimens from the collections.

Requirements for museum administration-

- Work areas
- Multipurpose room –where informal meetings are conducted
- Meeting areas
- IT rooms- devoted to the continuous operation of computer servers ,data center and is air conditioned
- Archives-place where all historical records are stored
- Supporting office
- Conference room
- Employee area
- Rest room

Max areas for meeting & conference rooms in museum administration

TYPE	.AREA(sqm)
Meeting room(up to 8 persons)	15
Conference room(12 persons)	25
Conference room (18 persons)	32

ARCHIVE ROOM

IT ROOM

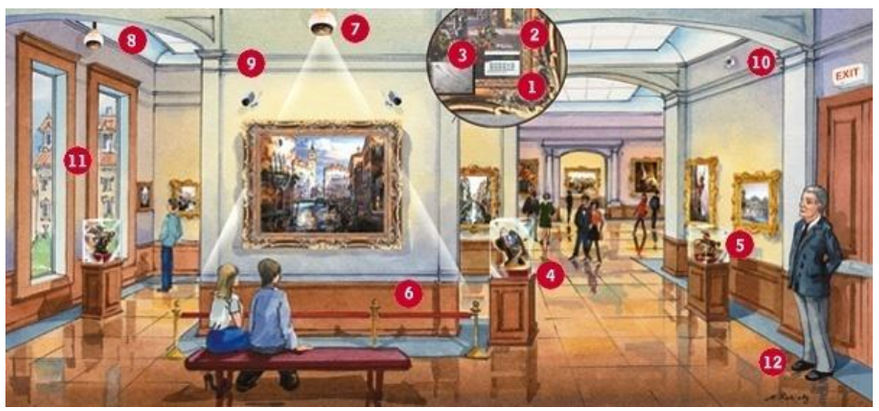
MUSEUM SECURITY

- Most museums require at least two types of alarm systems: burglar alarms and fire alarms.

❖ TYPES OF SECURITY SYSTEMS

1. Vibration sensors
2. Environmental sensors
3. Motion detection devices
4. Saturation motion device
5. Cctv cameras
6. Fire alarms, sprinklers, temperature controls
7. Eye hooks
8. Window alarms
9. Security guards

- Visitors tend to touch, lean forward as a result of strong impulses.
- People observe other people's behavior and pick up non-verbal clues about what to do.



REF: Security

- http://www.securitycommittee.org/securitycommittee/Guidelines_and_Standards_files/SuggestedPracticesRev06.pdf
- http://www.csoonline.com/article/2122573/physical-security/museum-security--the-art-of-securing-pricelessness.html

CURATOR

- Curator is a manager or a keeper.
- A traditional curator's concern involves tangible objects- artwork, collectibles, historic items etc..

CURATOR RESPONSIBILITIES

- He will conduct researches on objects and guide public through exhibitions and publications.
- In large museums, multiple curators assigned to specific area- ancient art, prints and drawings etc.
- As a teacher and facilitator through materials and digital words.

- Physical care of collections by museum conservators.
- Documentation and administration matters by museum registrar.

RETAIL SECTION OF MUSEUM

- This section is gaining popularity in recent times.
- Museum spaces an be used for exhibition or other events.
- Retailers can sell various collections to the visitors, such as antique collection or other products.
- The retailers focus on the reasons that make the non visitors and focus on to improve on those sections for greater audience range.

STANDARD SIZES :

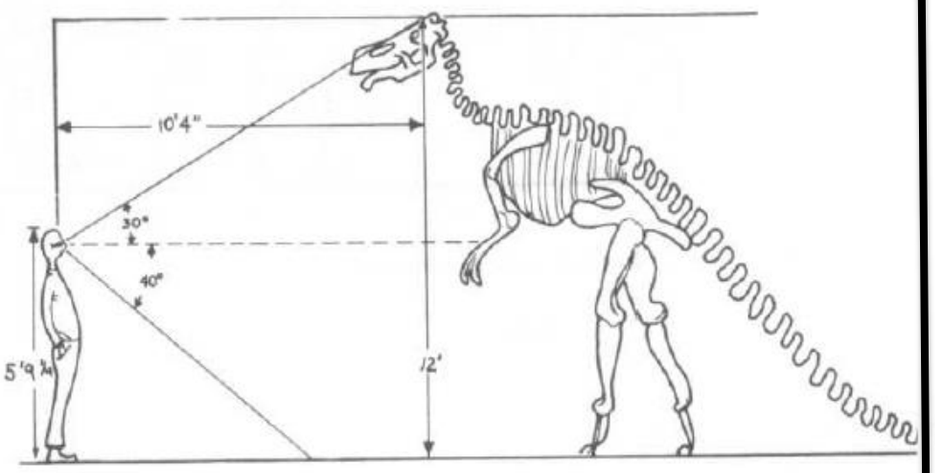


Fig. 6 Viewing distance should increase with greater size of object.

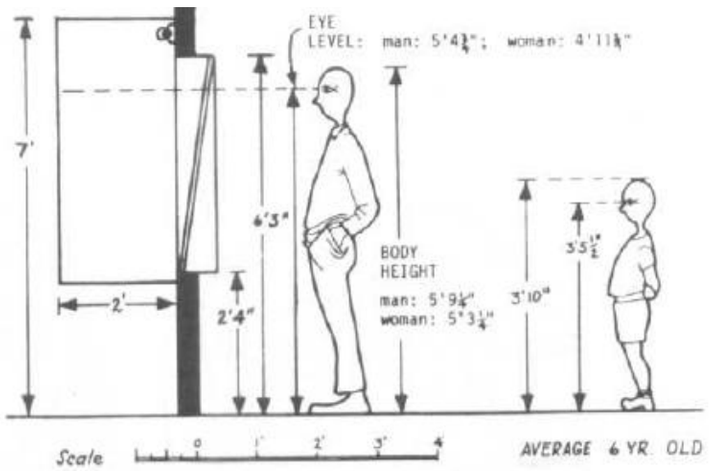


Fig. 4 Measurements of adult and six-year-old visitors in relation to cases.

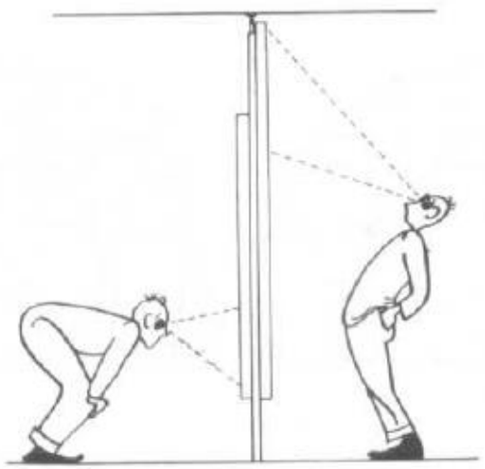


Fig. 5 Difficulties encountered in viewing details more than 3 ft below or 1 ft above one's eye level.

REF: Standard sizes

- https://www.si.edu/Accessibility/SGAED
- http://dc.uwm.edu/cgi/viewcontent.cgi?article=1015&context=caupr_mono
- https://www.britishcouncil.in/sites/default/files/guidelines_for_museum_display.pdf

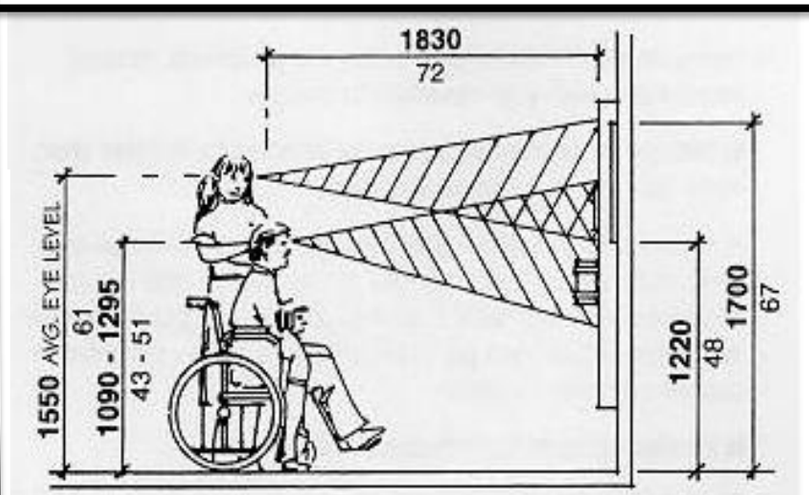
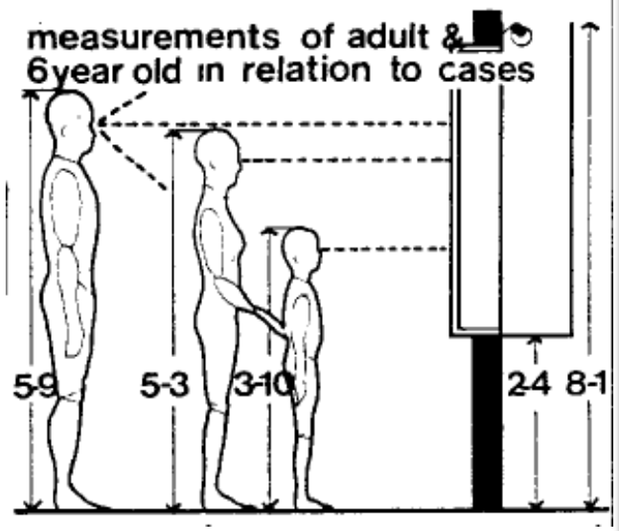
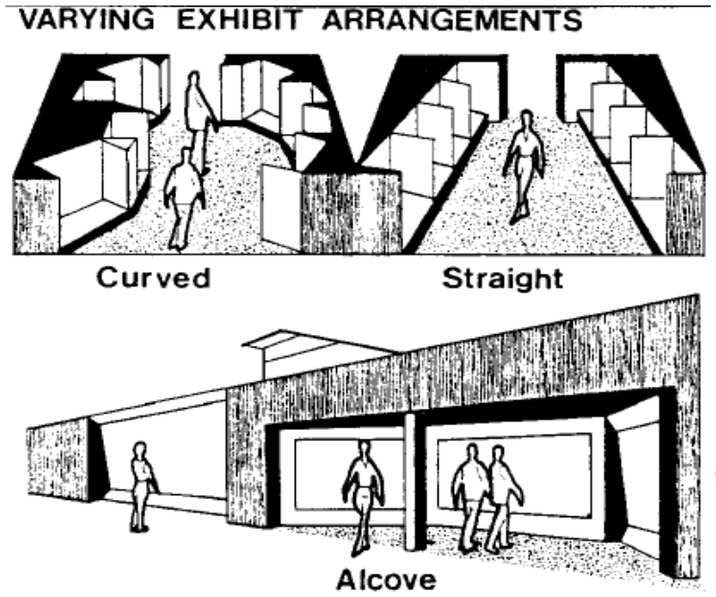
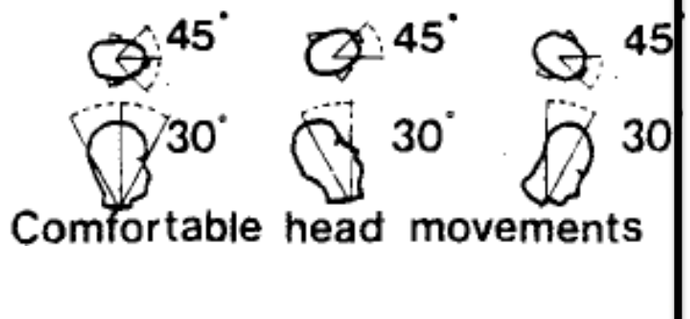
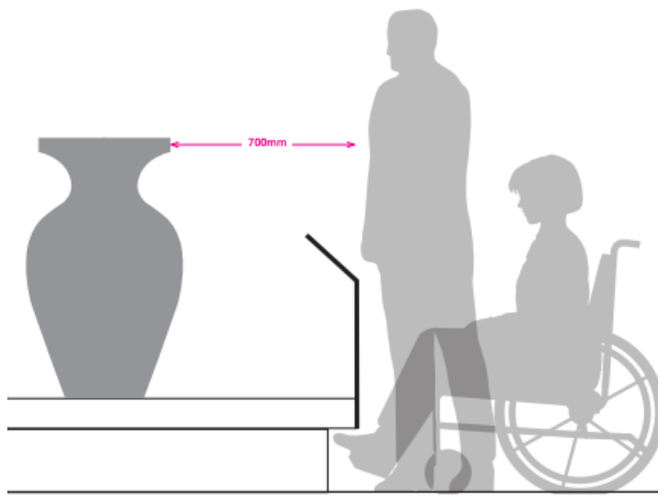


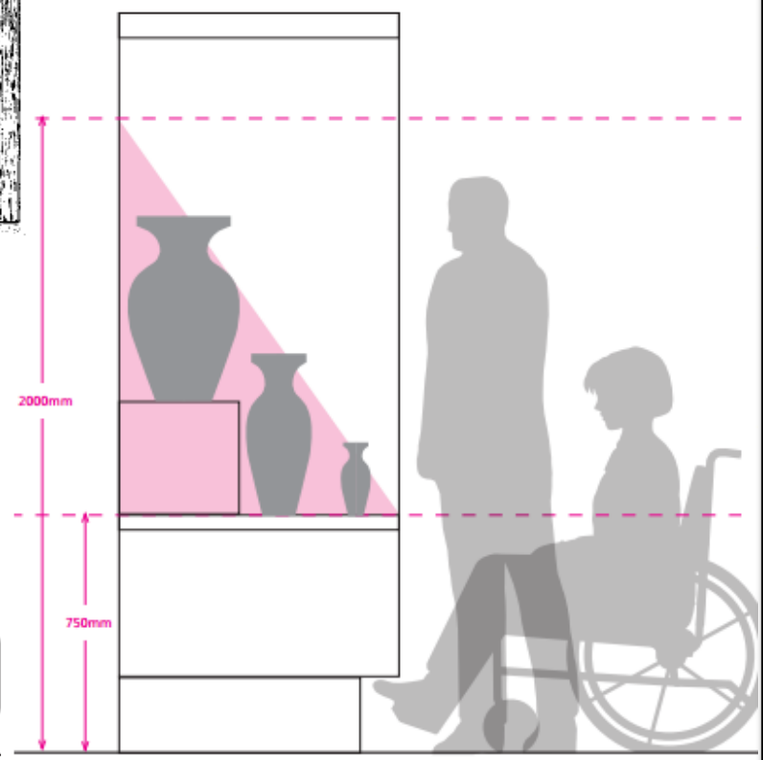
Fig. 3 Average viewing sightlines



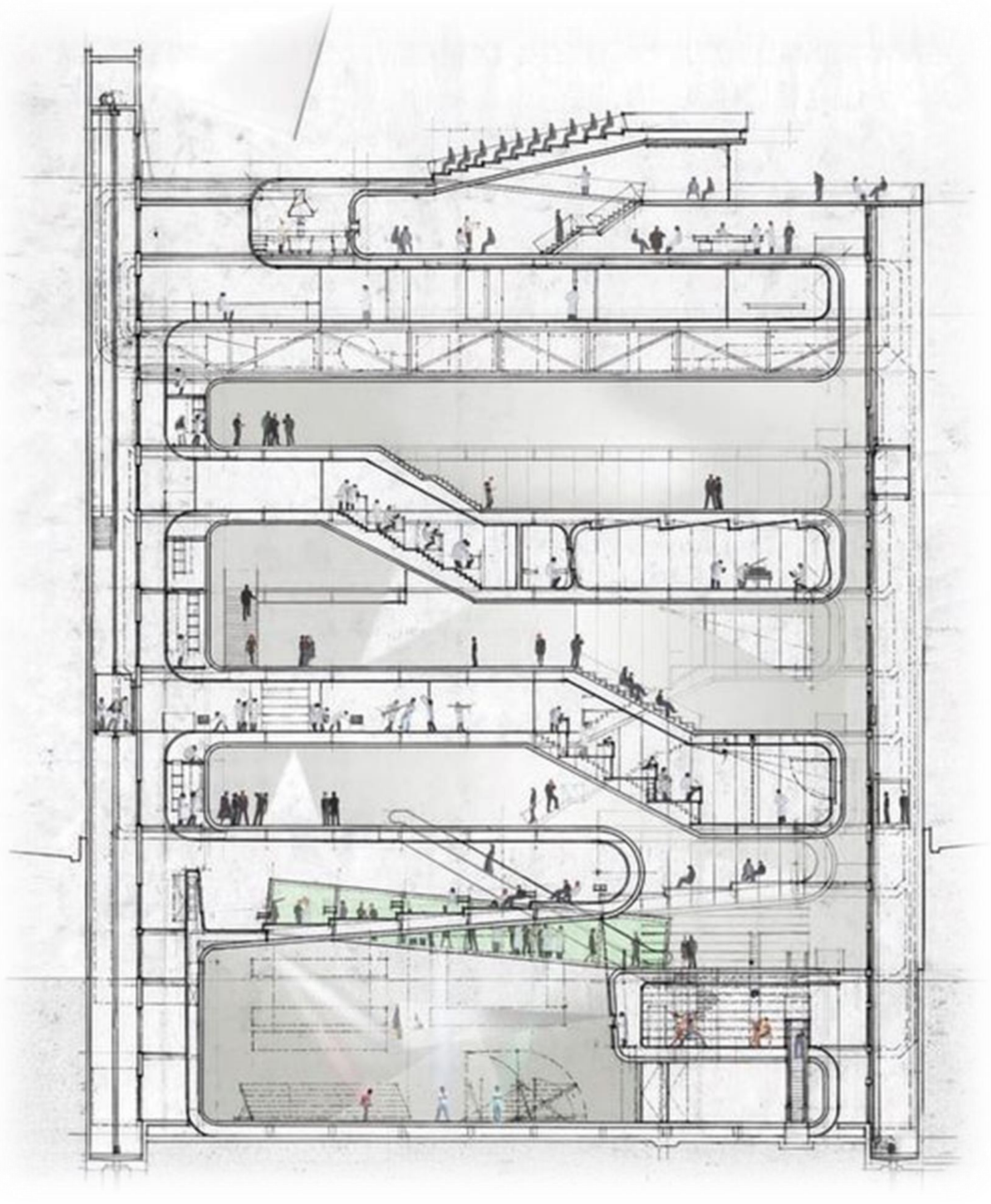








CIRCULATION SYSTEM IN A MUSEUM



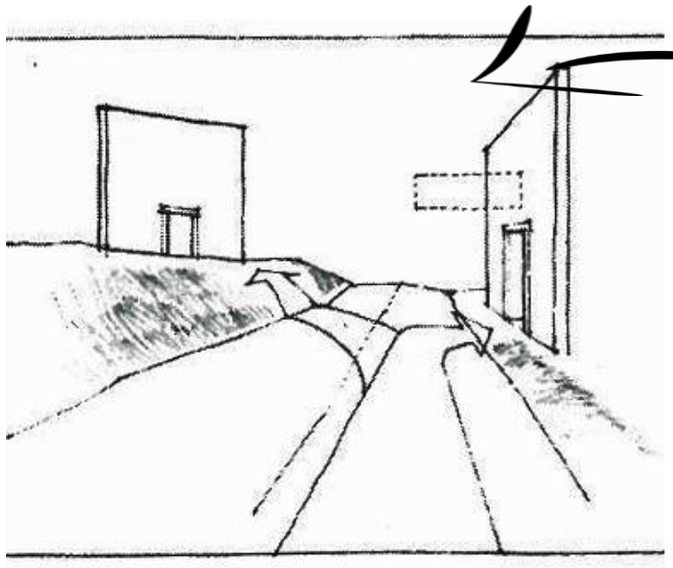
CONTENTS

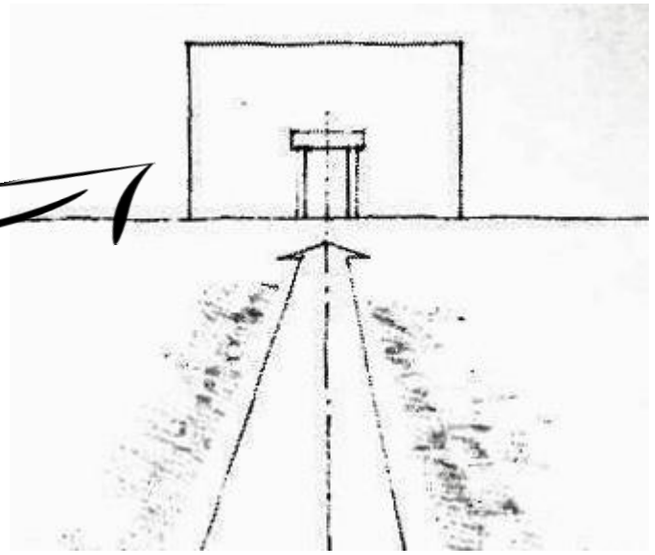
CIRCULATION

- The journey or the circulation path can be conceived as the perceptual thread that links the various spaces of a building be it the exterior with the interior or various interior spaces within the building in relation with time.
- The design of circulation throughout a built environment starts from the approach road that leads to entry into the site.

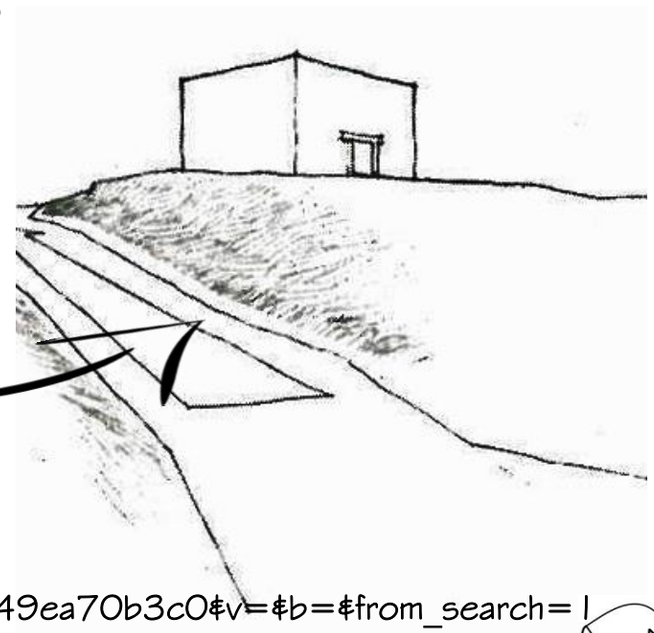
TYPES OF APPROACH

- **Frontal**: A frontal approach leads straight to the building along an axial path where the visual goal at the end of the approach is clear





- **Oblique:** An oblique approach enhances the effect of perspective on the façade and form of the building. This kind of approach can be redirected once or more times to prolong the sequence of approach.



- **Spiral:** A spiral approach prolongs the sequence of the approach and also emphasises the three-dimensional form of the building as movement progresses along the perimeter. The entrance could be visible intermittently to clarify position or can be hidden until the point of arrival.

REF: Architecture, Form, Space & Order By Francis DK Ching
http://www.slideshare.net/kumarsadananda/circulation-11087408?qid=abb872c1-11a8-4be1-8afe-5549ea70b3c0&v=&b=&from_search=1

GUIDELINES FOR CIRCULATION AT SITE LEVEL

Providing for access and circulation for pedestrians, automobiles, and service vehicles is an important aspect of site planning, which influences both the location of a building on its site and the orientation of its entrances.

1. Provide for safe and convenient pedestrian access and movement to building entrances from parking areas or public transit stops with minimal crossing of roadways.
2. Determine the number of parking spaces required by the zoning ordinance for the type of occupancy and total number of units or floor area of the building.
3. Determine the number of accessible parking spaces as well as curb cuts, ramps, and paths to accessible building entrances required by local, state, or federal law.
4. Provide loading zones for buses and other public transportation vehicles where applicable.
5. Separate service and truck loading areas from pedestrian and automobile traffic.
6. Furnish access for emergency vehicles such as fire trucks and ambulances.
7. Establish the required width and location of curb cuts and their proper distance from public street intersections.
8. Ensure clear sight lines for vehicles entering public roadways.
9. Plan for control of access to parking areas where required.
10. Provide space for landscaping; screening of parking areas may be required.
11. Slope paved walkways and parking areas for drainage.

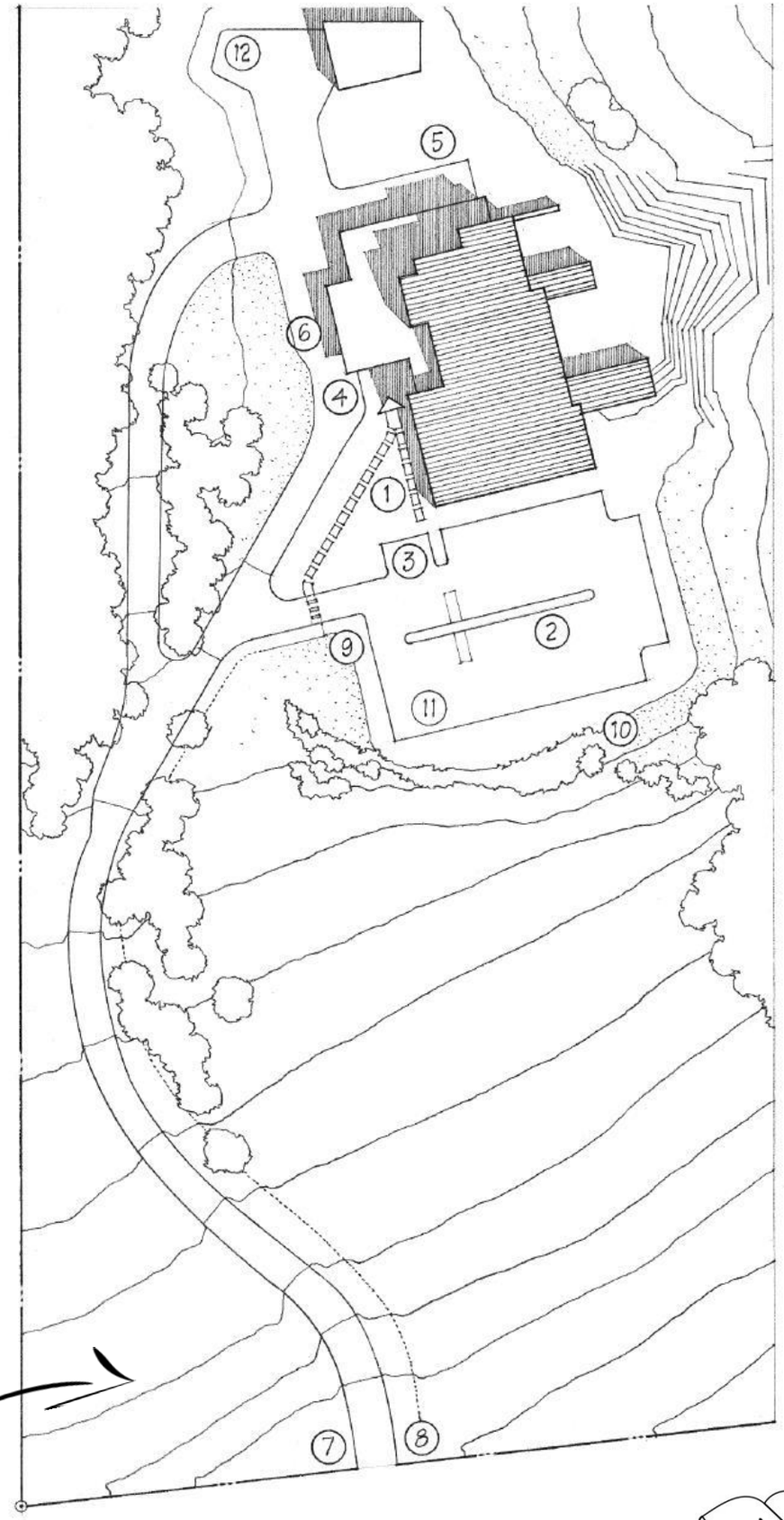
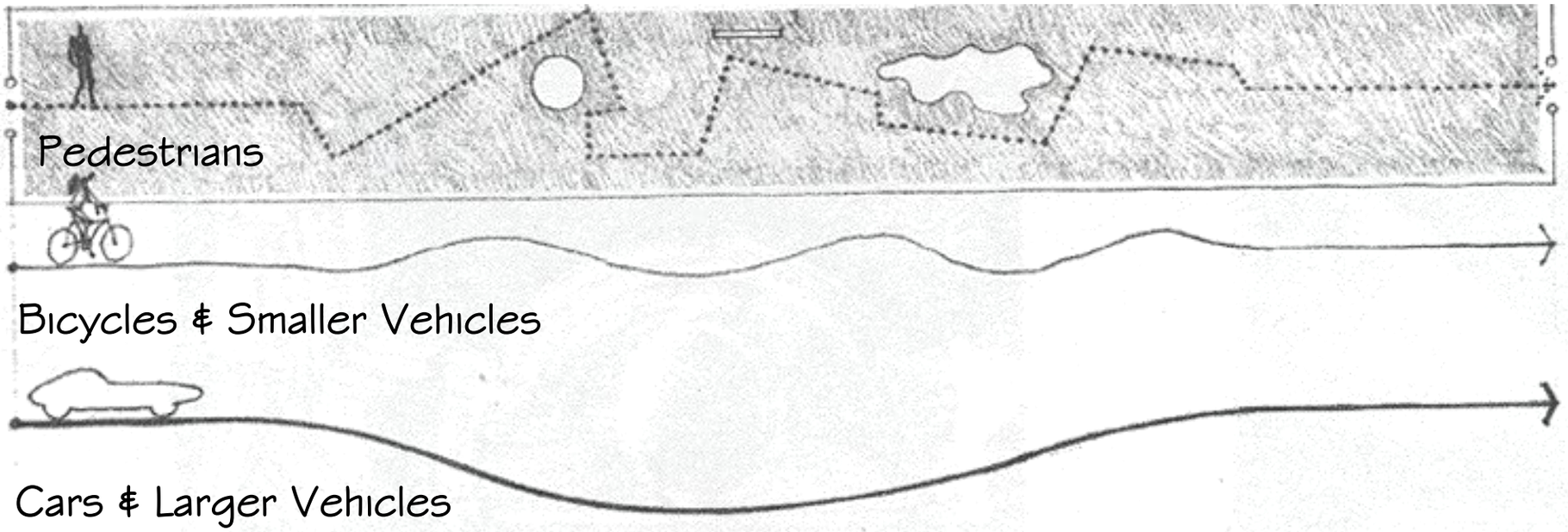


Illustration adapted from the site plan for the Carre House, designed by Alvar Aalto.

REF: Building Construction Illustrated By Francis DK Ching

CONFIGURATION OF PATHWAYS & DRIVEWAYS



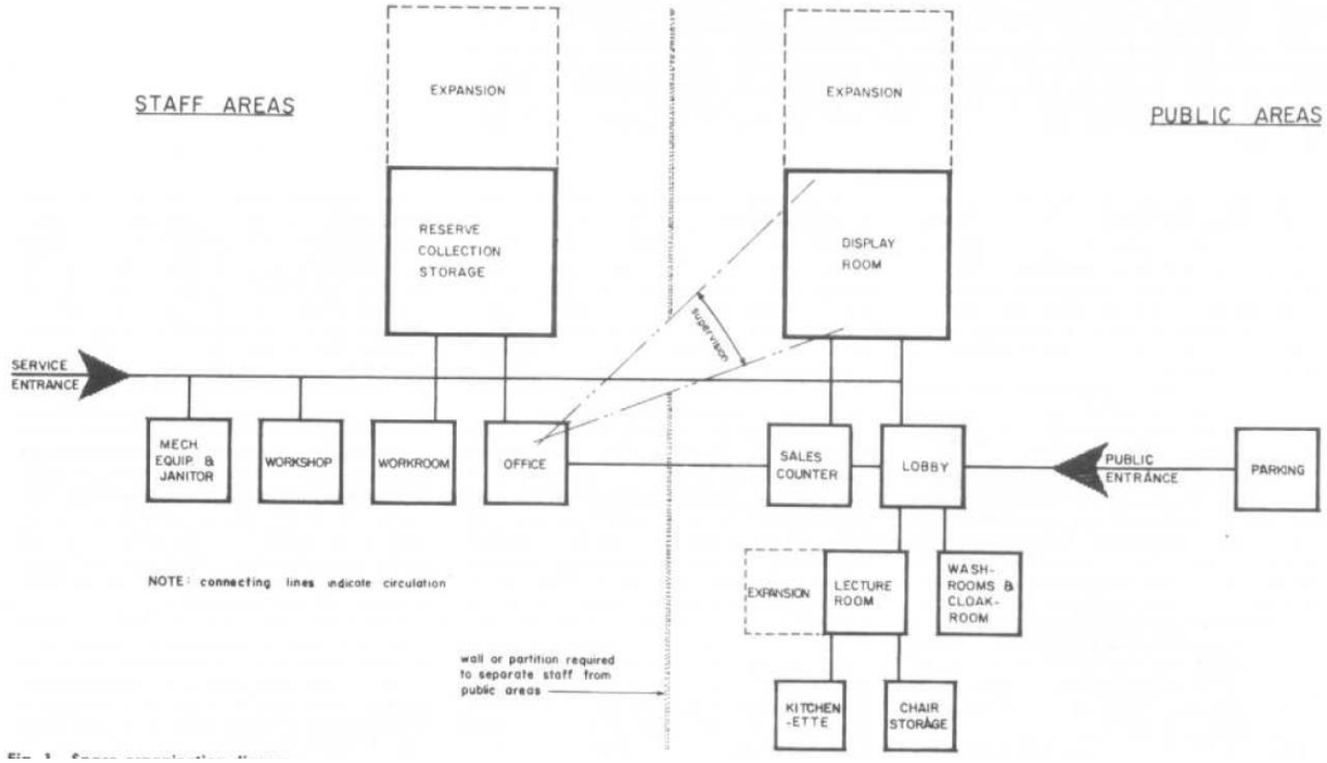
- The form and scale of entrances and paths must also convey the functional and symbolic distinction between public promenades, private halls, and service corridors
- If the paths at a crossing are equal, sufficient space must be provided to allow people to pause and orient themselves

ENTRANCE OF A BUILDING

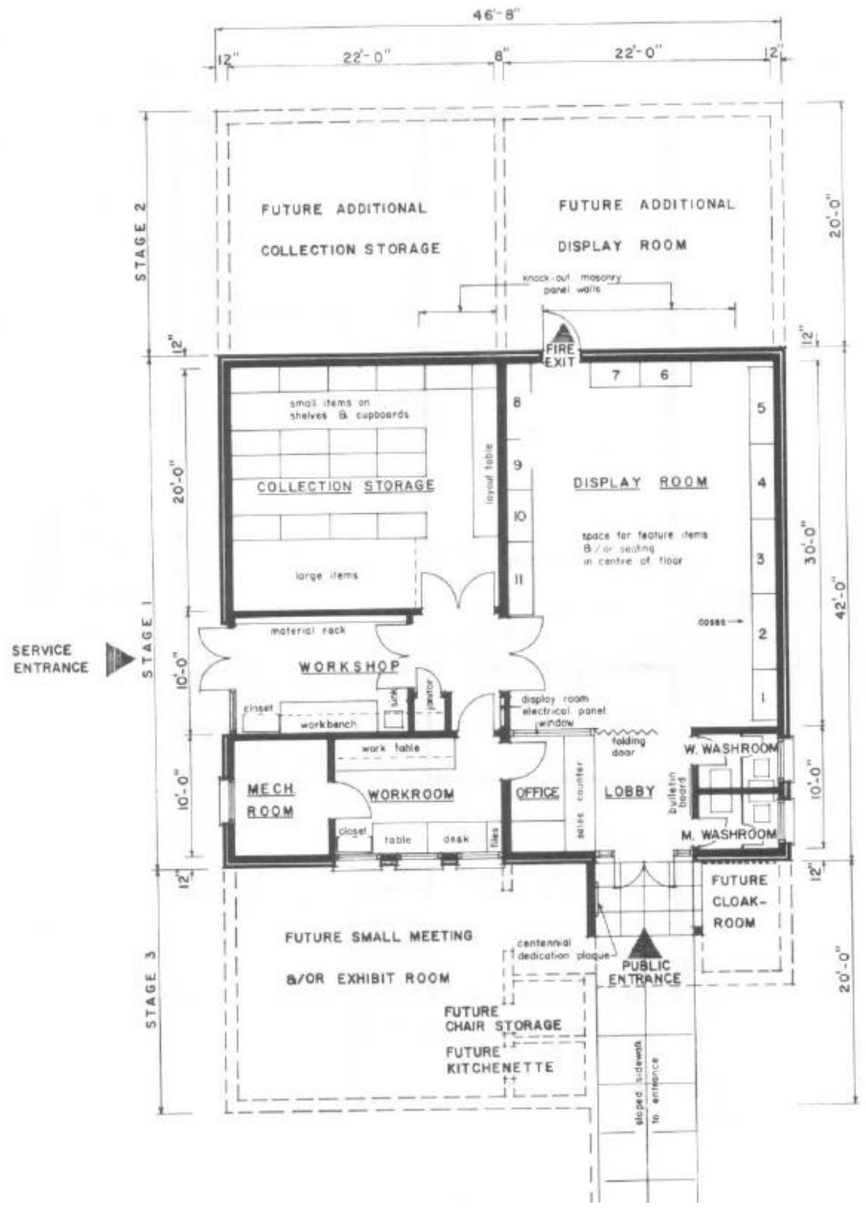
- Entering a space marks a transition in the vertical plane and hence should be made significant. Even though there is a difference in the spaces, greater visual and spatial continuity is desired.
- The Entrance can be emphasised by a change in the level or by a gateway etc. No matter what the form of the space is or the form of the enclosure, an entrance is best signified by establishing a plane perpendicular to the plane of approach.

REF: Architecture, Form, Space & Order By Francis DK Ching
http://www.slideshare.net/kumarsadananda/circulation-11087408?qid=abb872c1-11a8-4be1-8afe-5549ea70b3c0&v=&b=&from_search=1

ZONING AND PLANNING OF SPACES IN A MUSEUM



ZONING



BASIC PLAN

BASIC PLAN

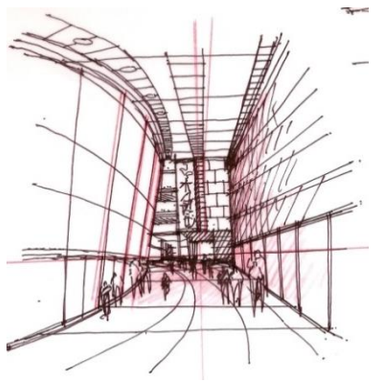
- This plan shows minimum sizes of spaces required for an effective minimum museum.
- The display area is only about 40 percent of the building.
- Sufficient space left for future expansion.

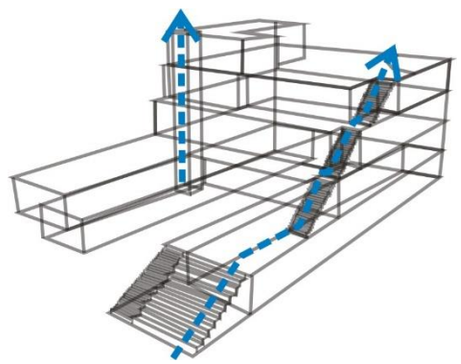
REF: Time Savers Standards (TSS)

CIRCULATION WITHIN A BUILDING

The circulation within a building is chiefly categorized into two

- Horizontal Circulation (Corridors, Lobbies, Foyers, etc.)
- Vertical Circulation (Stairs, Ramps, Elevators & Escalators)





FORM OF THE CIRCULATION SPACE

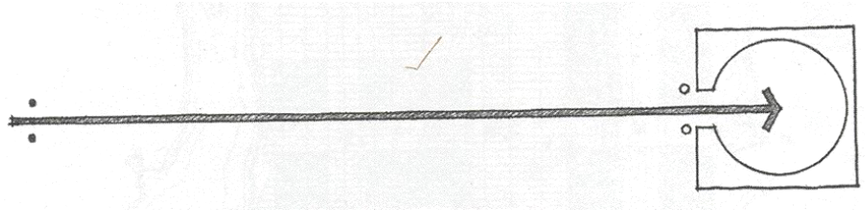
- Spaces for movement form an integral part of any building organization and occupy a significant amount of the volume of a building
- If considered just as functional linking devices, then circulation paths would be endless, corridor-like spaces
- The form and scale of a circulation space, however, should accommodate the movement of people as they walk, pause, rest, or take in a view along a path

PATH-SPACE RELATIONSHIPS

Paths may be related to the spaces they link in a number of ways

✓ Terminate in a Space

- The location of the space establishes the path
- This path-space relationship is used to approach and enter, functionally or symbolically important spaces

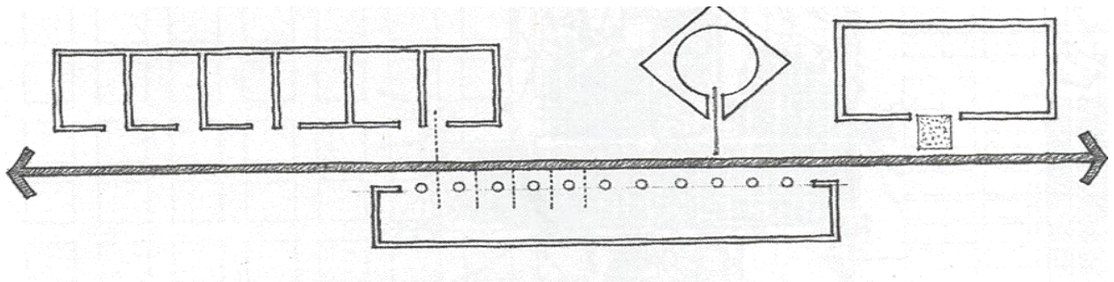


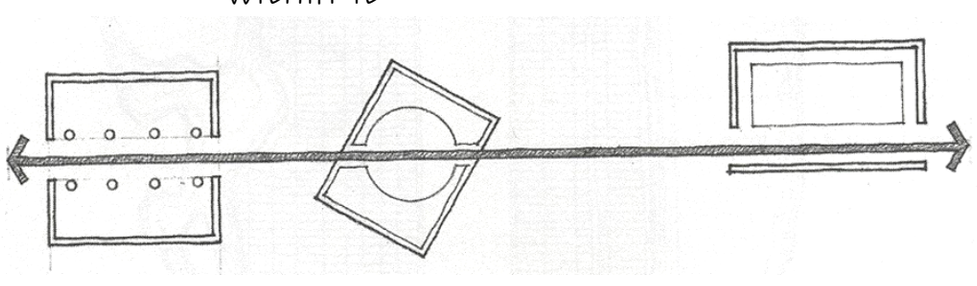
✓ Pass through Spaces

- The path may pass through a space axially, obliquely or along its edge
- In cutting through a space, the path creates pattern of rest and movement within it

✓ Pass by Spaces

- The integrity of each space is maintained
- The configuration of the path is flexible
- Mediating spaces can be used to link the path with the spaces

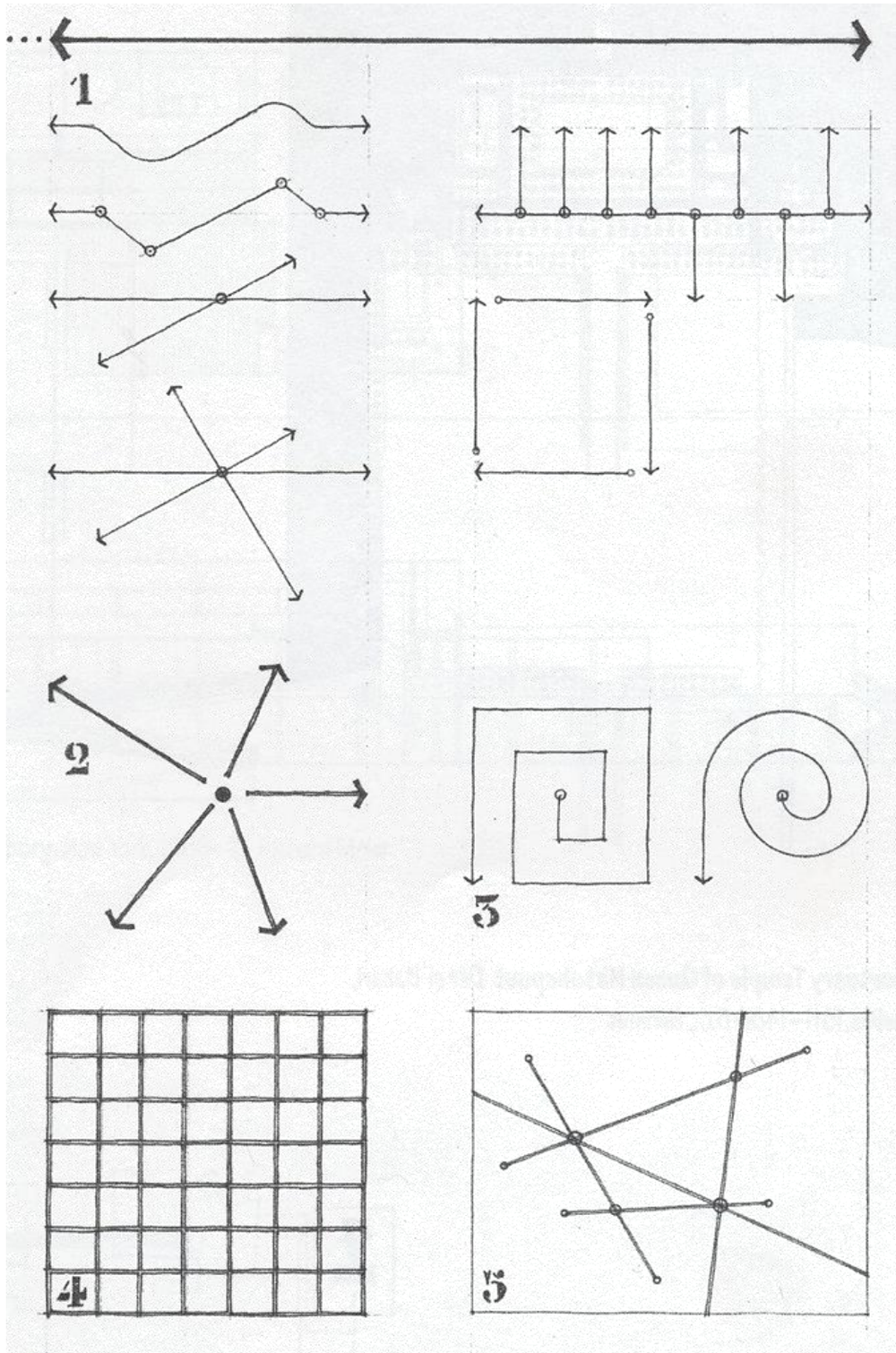




REF: Architecture, Form, Space & Order By Francis DK Ching
http://www.slideshare.net/kumarsadananda/circulation-11087408?qid=abb872c1-11a8-4be1-8afe-5549ea70b3c0&v=&b=&from_search=1

CONFIGURATION OF CIRCULATION FOR VARIOUS SPATIAL ARRANGEMENT

- **LINEAR**
  - All paths are linear
  - A Straight path, can be the primary organizing element for a series of spaces
  - Also it can be curvilinear or segmental, intersect other paths, have branches or form a loop
- **RADIAL**
  - A Radial configuration has linear paths extending from or terminating at a central, common point
- **SPIRAL**
  - A Spiral configuration is a single, continuous path that originates from a central point, revolves around it and becomes increasingly distant from it
- **GRID**
  - A Grid configuration consists of two sets of parallel paths that intersect at regular intervals and create square or rectangular fields of space
- **NETWORK**
  - A Network configuration consists of paths that connect established points in space
- **COMPOSITE**
  - In reality, a building usually employs a combination of the different paths
  - Important points in any pattern are centres of activity, entrances to rooms and halls and places for vertical circulation provided by stairways/ramps and elevators



REF: Architecture, Form, Space & Order By Francis DK Ching
http://www.slideshare.net/kumarsadananda/circulation-11087408?qid=abb872c1-11a8-4be1-8afe-5549ea70b3c0&v=&b=&from_search=1

UNIVERSAL DESIGN CONSIDERATIONS

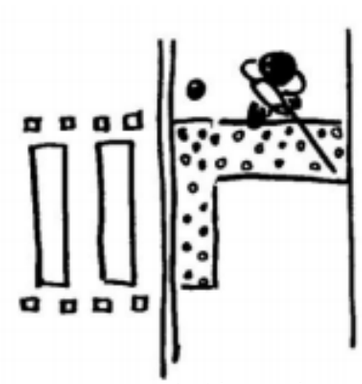
SITE PLANNING

- **Walkways and paths**
  - Incorporating clear and consistent paving.
  - Incorporating wide pathway. (Min 1650mm for a wheelchair and a walker as per CPWD Guidelines)
  - Ensuring minimal street clutter.
  - Using blister surfacing for pedestrian crossing points.
  - Using corduroy hazard warning surfacing.

Difference in level

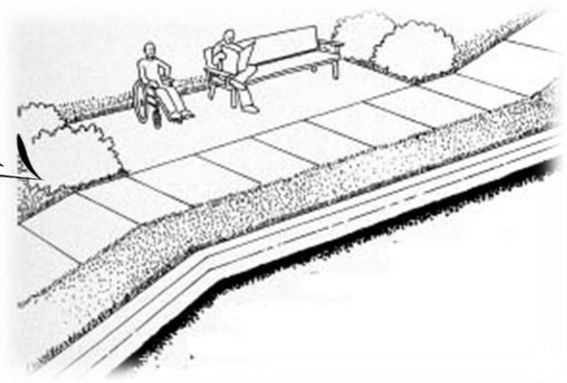
Shape of level difference

Blister Surface/Tactile signal at intersections



Covered Walkways for protection against the elements as well as a defining feature of designated pedestrian access

Resting areas for everybody as a part of universal design at the required distance



REF:Building for Everyone: A Universal Design Approach, As part of National Disability Act (NDA), Ireland

- **Typical Detail of Walkway**
  - Walkway should be constructed with a **non-slip material** & **different** from rest of the area.
  - The walkway **should not cross vehicular traffic.**
  - The manhole, **tree** or any **other obstructions** in the walkway should be **avoided.**
  - **Guiding block** at the **starting of walkway & finishing** of the walkway should be provided.

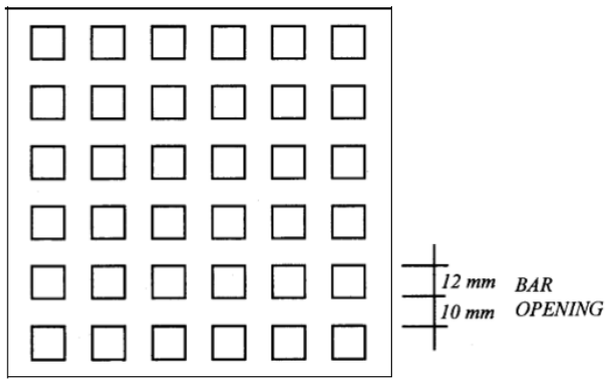
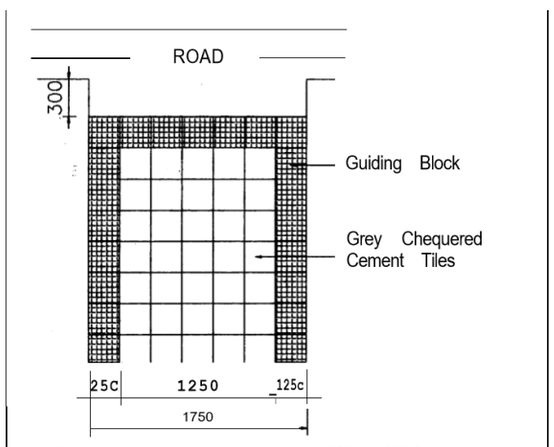


Fig. 13 Details of Grating



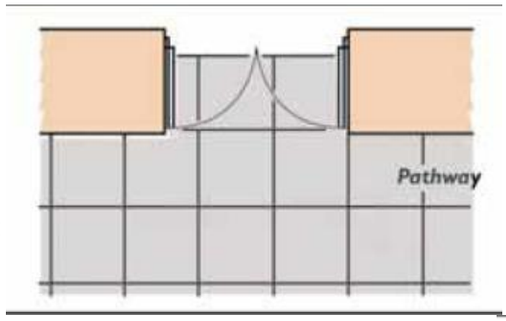
(The Width of the Walkway can vary from 1750 to 1800 Depending on the Tile size i.e. 250mm to 300mm.)

➢ Parking

- The needs of pedestrians should be taken into account when designing the layout of parking. This includes both those who have parked and those accessing on foot.
- Pedestrian access, segregated or shared surface, should be provided along the routes within the car park, rather than simply relying on the vehicular route.
- The provision of raised footways, through the car park and crossing points across main vehicle routes will help to alleviate conflict between pedestrians and vehicles.
- A tactile distinction should be made between pedestrian areas and vehicular areas, in order that people with visual impairment can distinguish between the two. Provision of raised areas, footway areas and tactile paving at all dropped kerbs should achieve this.
- Signage/information stating that the space is reserved for the differently abled.
- A covered pathway leading from the parking to the accessible entrance without the risk of passing though vehicular traffic.
- Guiding floor materials shall be provided or a device which guides visually impaired persons with audible signals or other devices which serve the same purpose..

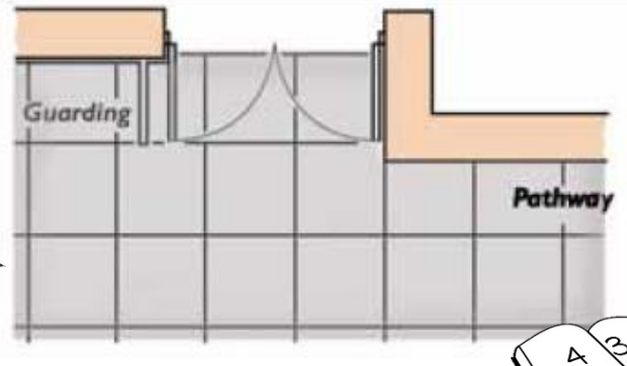
➢ Accessible Entrances

- Ensure entrances are clearly visible and prominent.
- Provide Ramps for universal accessibility.
- Provide adequate space inside and outside entrance doors.
- Arrange outward-opening doors so that they are recessed or guarded.
- Ensure threshold to entrances are very minute with chamfered, pencil-rounded or ramped profile.
- Provide canopy or door recess for weather protection.



Recessed Doorways

Guarding Doorways



REF:Building for Everyone: A Universal Design Approach, As part of National Disability Act (NDA), Ireland & Inclusive Mobility, Govt. Of United Kingdom

➢ Entrance doors

- Provide adequate clear space on both sides of doors
- Incorporate vision panels into all entrance and entrance lobby doors.
- Incorporate visually contrasting markings at two levels on all glazed doors and screens
- Make sure entrance doors contrast visually with adjacent walls or screens.
- Include a highly contrasting strip on all edges of frameless glass doors.

➢ Entrance lobbies

- Provide an entrance lobby only where absolutely necessary.
- Ensure external and internal doors are accessible, understandable and useable.
- Ensure lobbies are clear of obstructions such as displays or stored items.
- Make sure lighting eases the transition between external and internal environment.
- Highlight glazed screens and doors effectively.
- Ensure mats are firm and flush with the adjacent floor surface.

Matted surface flush to the flooring to avoid tripping and hindrance of movement

Automatic entrance doors that lead into the lobby and are accessible to all

➢ Internal lobbies

- Avoid creating internal lobbies unless absolutely necessary.
- Install floor surfaces that are firm and level.
- Ensure junctions between different floor finishes are fixed with threshold plates.

➢ Corridors

- Design as per the standard guidelines
- Recess wall-mounted items wherever possible.
- Ensure any projections into the clear width are guarded.
- Consider using handrails for certain building types and in all cases where corridors are over 20m long.
- Provide seats at no more than 20m intervals on long corridors

Corridor in British Museum

REF:Building for Everyone: A Universal Design Approach, As part of National Disability Act (NDA), Ireland

➢ Reception and waiting areas

- Ensure logical arrangement of circulation routes and facilities
- Make sure reception desk is clearly visible with direct route from entrance doors
- Provide induction loop system at reception desk.
- Install well-designed lighting to optimise visual communication and lip reading.
- Choose floor finishes that are firm and slip-resistant.
- Provide comfortable seating and free space for wheelchair users; parents with strollers; people with visual difficulties; guide dog users; and those with walking aids.
- Locate toilet facilities adjacent to reception area.
- Highlight the location of key facilities with well-designed, clear signage.
- Ensure telephones or combined telephone, text and email units are accessible and useable.

Braille Signage for visually impaired people

Example of signage for an induction loop at a reception desk.

Alternative view of a reception desk with two levels

➢ Queuing areas and temporary barriers

- Fix queuing barriers firmly to the floor.
- Leave sufficient aisle width for wheelchair and crutch users.
- Ensure barriers incorporate rigid handrail and visually contrast with surrounding surfaces.
- Make sure sockets for temporary barriers are flush with floor surface and incorporate cap or cover.
- Limit the use of unfixed barriers.
- Provide seating at queuing areas.
- Turnstiles
  - ✓ Provide an accessible gate wherever turnstiles are located.
  - ✓ Ensure gates contrast visually with surroundings and are clearly signed.

Fixed queue barriers in receptions

Turnstiles with Wheelchair Accessibility

REF:Building for Everyone: A Universal Design Approach, As part of National Disability Act (NDA), Ireland

➢ Vertical circulation

- Avoid changes of level within a storey for new buildings.
- Design and maintain stairs to provide safe access at all times even if rarely used.
- Install passenger lifts in preference to other devices, as they provide the most convenient means of vertical circulation.

Providing Vertical Circulation such as Ramps, Stairs, Escalators, Lifts etc.

➢ Internal stairs

- Make sure each step edge is visually highlighted
- Incorporate clear width of steps to suit expected level of use
- Avoid single steps on an access route.
- Provide clear landings at top and bottom of steps, with the length equivalent to the step width.
- Use tactile hazard warning surface at top and bottom of flight, only if deemed appropriate following risk assessment.
- Provide handrails on both sides of the steps and continuous around intermediate landings
- Provide an additional central handrail where the stairs are more than 2000mm wide

Use of Tactile materials at the top and bottom of the Stairs

➢ Internal ramps

- Ensure maximum gradient of a ramp is 1 in 20
- Make sure the gradient of a ramp slope is constant and consistent throughout and between consecutive ramp slopes.
- Incorporate top and bottom landings Provide handrails on both sides of the ramp and continuous around intermediate landings
- Provide a kerb upstand or guarding to the side of ramp.

Contrasting colours of handrails and ramp floor finish

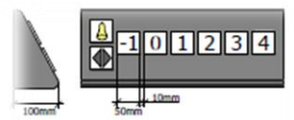
Flush carpet finish for ramps

REF:Building for Everyone: A Universal Design Approach, As part of National Disability Act (NDA), Ireland

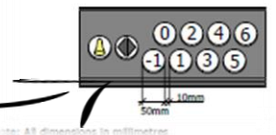
➢ Lifts

- Provide passenger lifts in preference to platform lifts, wherever possible.
- Locate passenger lift adjacent to an accessible flight of stairs.
- Ensure lifts are clearly signed from building entrance and other key areas.
- Ensure that all lifts are accessible , where more than one lift is provided.
- Design a lift door arrangement that is consistent and logical.
- Provide visual and tactile floor numbers at each landing.
- Position landing and lift car controls within reach of all users.
- Install control buttons that are easy to use
- Ensure the lift signalling system is both visual and audible.
- Provide an emergency communication system that is suitable for all users.
- Provide half-height mirror to rear wall.
- Install handrails on all walls without doors.

Use of contrasting surfaces in a lift with a grab-rail at the opposite side of the entrance



Visual & Tactile floor numbers



➢ Escalators

- Ensure the direction of travel is clearly signed
- Make sure the footway at each end contrasts visually and install a change in floor finish.
- Ensure moving handrails extend 300mm minimum beyond the start and end of escalator.
- Ensure escalator steps are a minimum of 580mm wide and a maximum of 1100mm wide. Provide maximum step height of 240mm, or 210mm if escalator used for emergency escape when stationary.
- Incorporate contrasting band to full width of each step edge.
- Install visually-contrasting handrails.
- Employ escalator speed not exceeding 0.75m per second.
- Ensure emergency stop controls are visible and accessible to all users.

➢ Travelators

- Install footway at each end that contrasts visually and a change in floor finish.
- Moving handrails to extend 700mm minimum beyond the start and end of walkway
- Install visually-contrasting handrails.
- Ensure recommended walkway width of 1500mm. Employ recommended speed of 0.5m per second.
- Ensure emergency stop controls are clear, visible, and accessible to all users.
- Restrict inclined travellators to maximum gradient of 1 in 20.
- Use fixed guarding at entry and exit points and alongside adjacent access routes. Ensure guarding contrasts visually.

STANDARDS AS PER CPWD GUIDELINES

Mobility devices

❖ Wheel chairs

- Standard size of wheel chair has been taken as **1050mm x 750mm** (as per ISI).

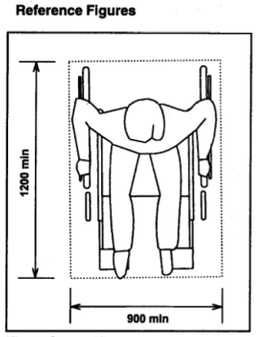


Fig.-1. Space Allowance

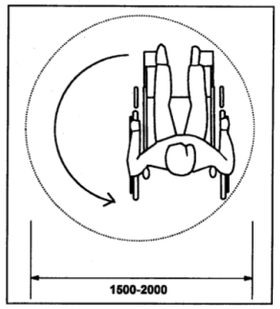


Fig.-2. Space Allowance

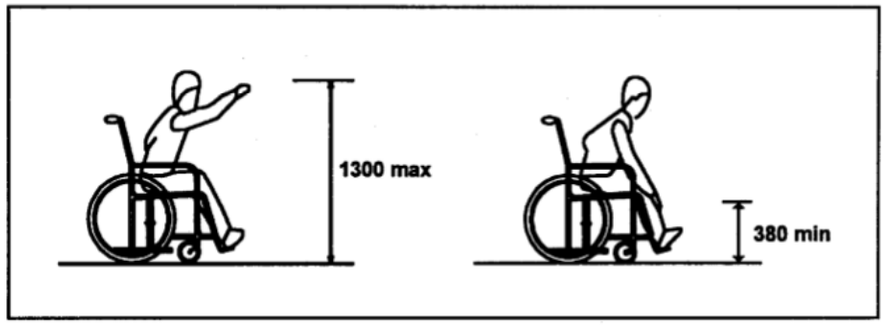


Fig.-3. Forward reach without obstruction

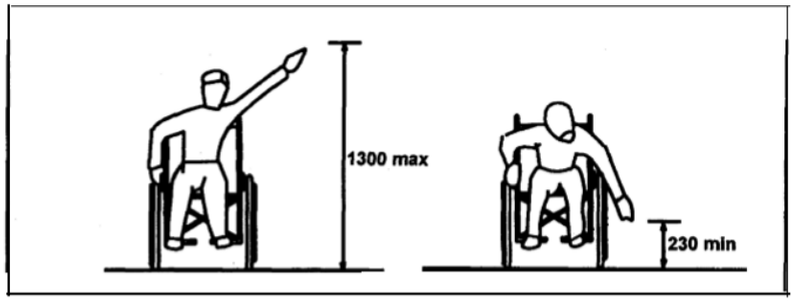


Fig.-5. Side reach without obstruction

❖ Crutches

A minimum width of 950 mm is desirable.

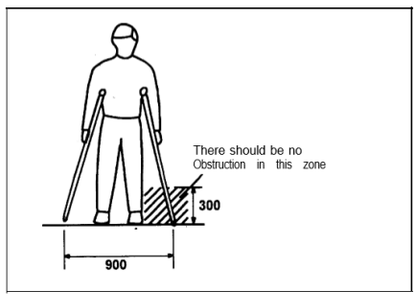


Fig. -7. Space Allowance,

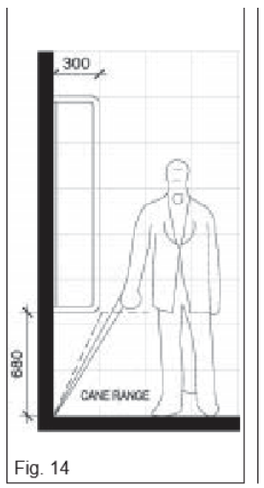


Fig. 14

❖ Cane

The radial range of the white cane is a band 900 mm wide

-Any obstacle above 750 mm cannot be detected by the white cane

. If there are projections above this height then the projections have to be reflected at the floor level in terms of level or textural differences.

Width

- The minimum clear width of an accessible route shall be 900 mm, except at doors.
- If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be 1100 mm or 900 mm

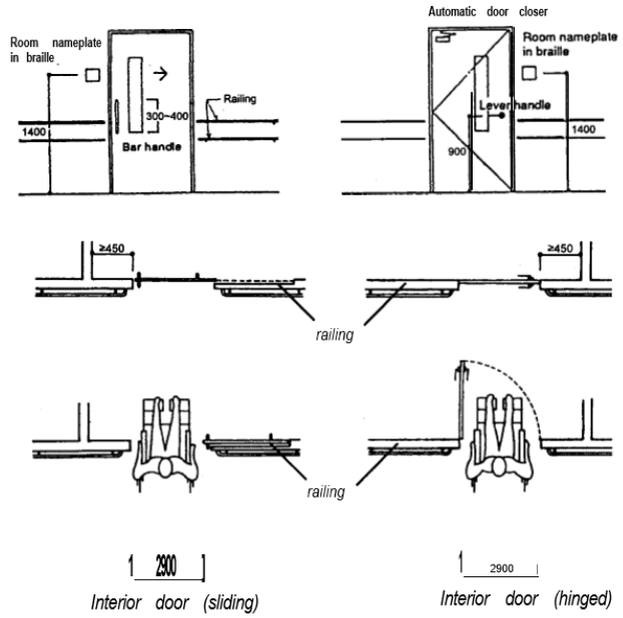
REF: CPWD Standard Guidelines for the Aged & Disabled, Govt. of India

Heights of people

- The average height of a person seated upon a wheelchair is generally **less than 1200 mm.**
- The average height of a standing person is generally **less than 2000 mm.**
- If vertical clearance of an area adjoining an accessible route is **reduced to less than 2000 mm,** (nominal dimension), a barrier or signage to warn visually impaired persons shall be provided.

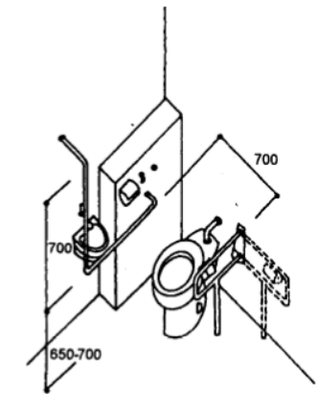
➢ Doorways

- **Minimum clear opening** of the entrance door shall be **900 mm**. and it shall not be provided with a step that obstructs the passage of a wheel chair user.
- **Threshold** shall not be raised more than **12 mm.**

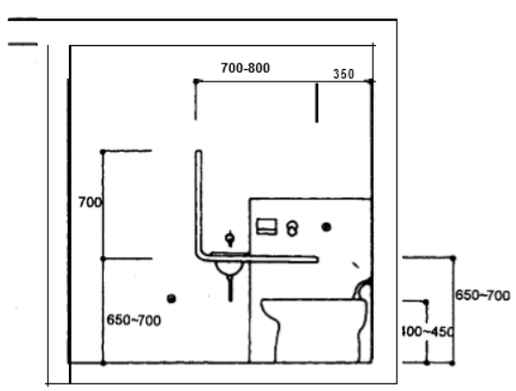


➢ Toilets

- One special W.C. in a set of toilet shall be provided for the use of handicapped with essential provision of wash basin near the entrance for the handicapped.
- The minimum size shall be 1500 x 1750 mm.
- Minimum clear opening of the door shall be. 900 mm and the door shall swing out.
- Suitable arrangement of vertical/horizontal handrails with 50 mm. clearance from wall shall be made in the toilet.
- The W.C. seat shall be 500 mm. from the floor.

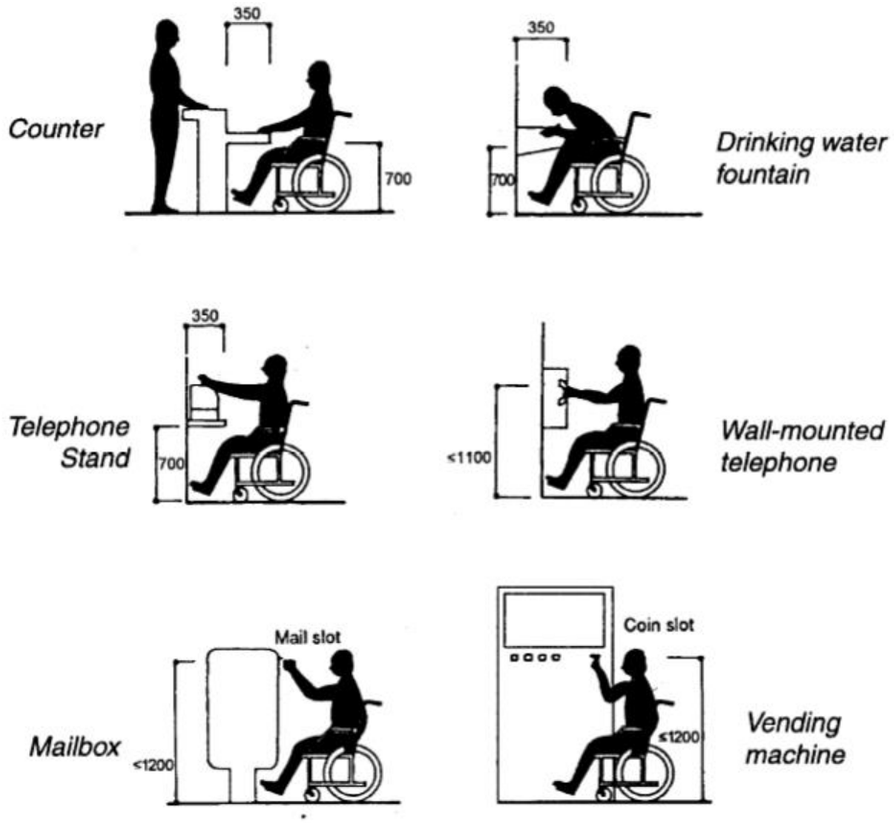


Handrail (Inside stall)

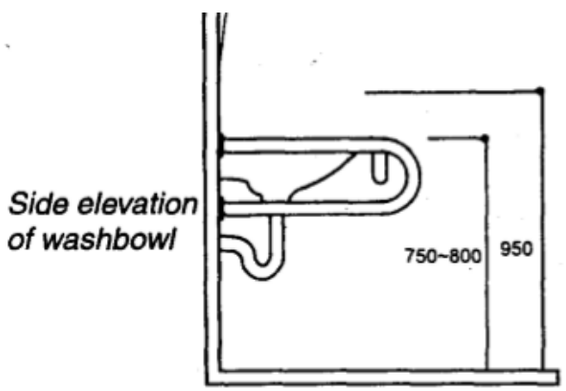


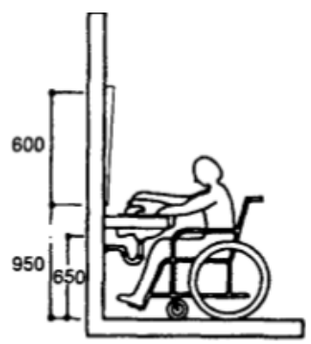
Side elevation of toilet stall

➢ The optimum dimensions for accessibility for all



➢ Washbasins





Use by a wheelchair user

REF: CPWD Standard Guidelines for the Aged & Disabled, Govt. of India

➢ Changes in levels

- If an accessible route has changes in level greater than 12 mm, then a curb ramp, ramp, elevator, or platform) shall be provided
- An accessible route does not include stairs, steps, or escalators

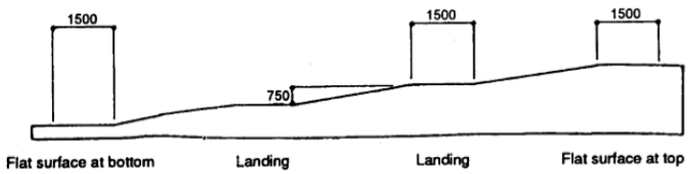
➢ Ramps

- Minimum clear width is 900mm.

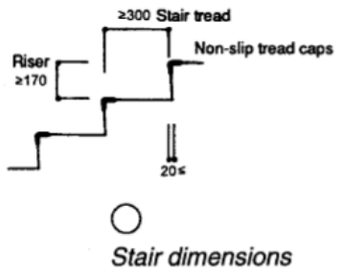
➢ Head room

- Walks, halls, corridors, passageways, aisles, or other circulation spaces shall have 2000 mm minimum clear head room

Maximum slope	Maximum length	Maximum rise
1:20 i.e., 9%	--	--
1:16 i.e., 6%	8 mts.	0.50 mts.
1:14 i.e., 7%	5 mts.	0.35 mts.
1:12 i.e., 8%	2 mts.	0.15 mts.
1:10 i.e., 10%	1.25 mts.	0.12 mts.
1:08 i.e., 12%	0.5 mts.	0.06 mts.

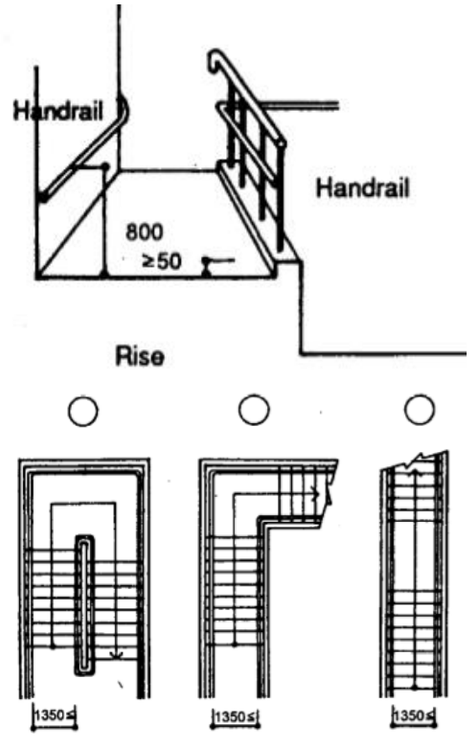


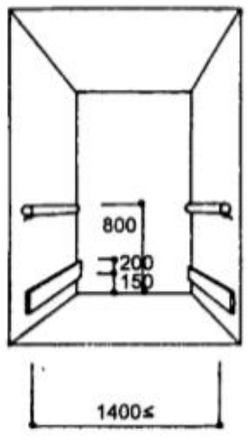
Cross Section of ramp



Stair dimensions

➢ Handrails





Cross section of corridor

REF: CPWD Standard Guidelines for the Aged & Disabled, Govt. of India

➢ Stairs

- On any given flight of stairs, all steps shall have uniform riser heights and uniform tread widths.
- Stair treads shall be no less than 280 mm wide, measured from riser to riser.
- Open risers are not permitted on an accessible stair.Risers should be 150mm.
- Provision of 900mm high handrail.

➢ Width of kerb ramp

- The minimum width of a curb ramp shall be 900 mm, exclusive of flared sides.

➢ Slope and rise

- The least possible slope shall be used for any ramp. The maximum slope of a ramp in a new construction shall be 1:12. The maximum rise for any run shall be 760 mm

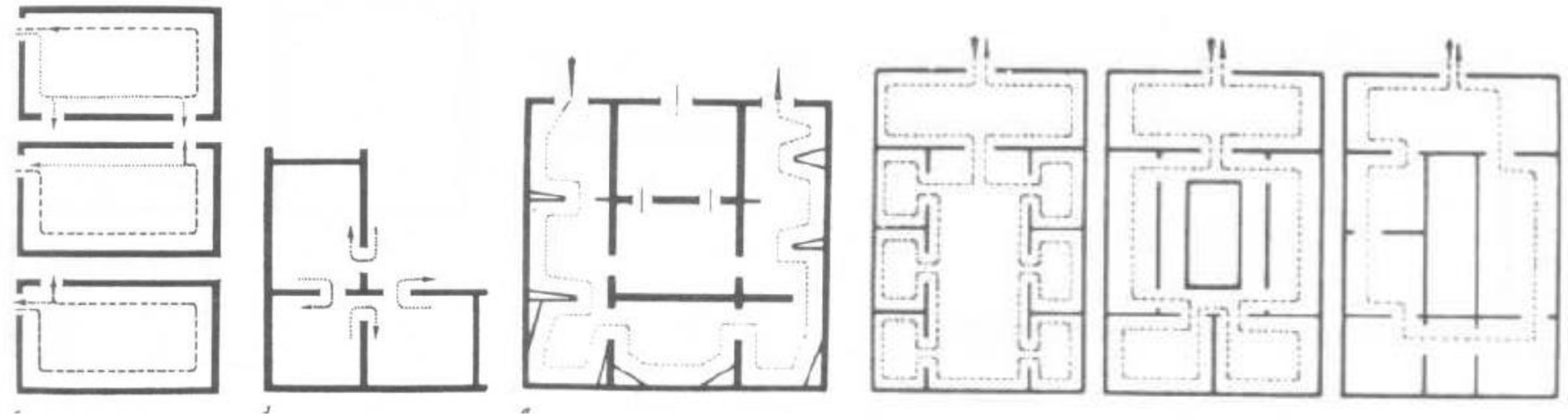
➢ Landings

- Ramps shall have level landings at bottom and top of each ramp and each ramp run, and at every 10 mts of run
- -The landing shall be at least as wide as the ramp run leading to it. The landing length shall be a minimum of 1500 mm clear
- -If ramps change direction at landings, the minimum landing size shall be 1500 mm x 1500 mm.

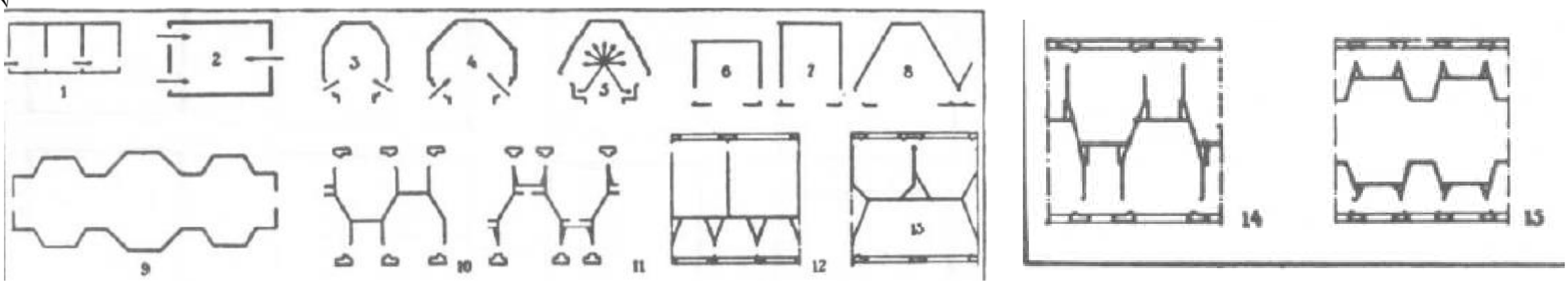
SPATIAL ARRANGEMENT FOR COMFORTABLE CIRCULATION

- An exhibition layout may show the intentions of a curator in presenting narratives in a particular viewing sequence, which implies a path visitors are expected to follow.
- The manner in which museum architecture and the layout of the exhibitions constrain visitor circulation may determine visitors' patterns of interaction with display objects.
- Therefore, the way in which circulation constraints are structured is the central question of museum design.
- The manner in which museum architecture and the layout of the exhibitions constrain visitor circulation may determine visitors' patterns of interaction with display objects.

➢ Various spatial arrangements possible in a museum



Conventional Style



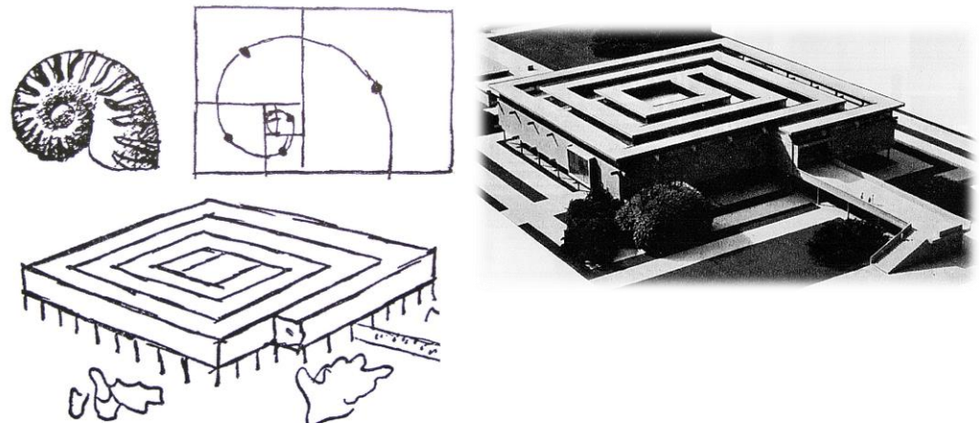
Modern Style

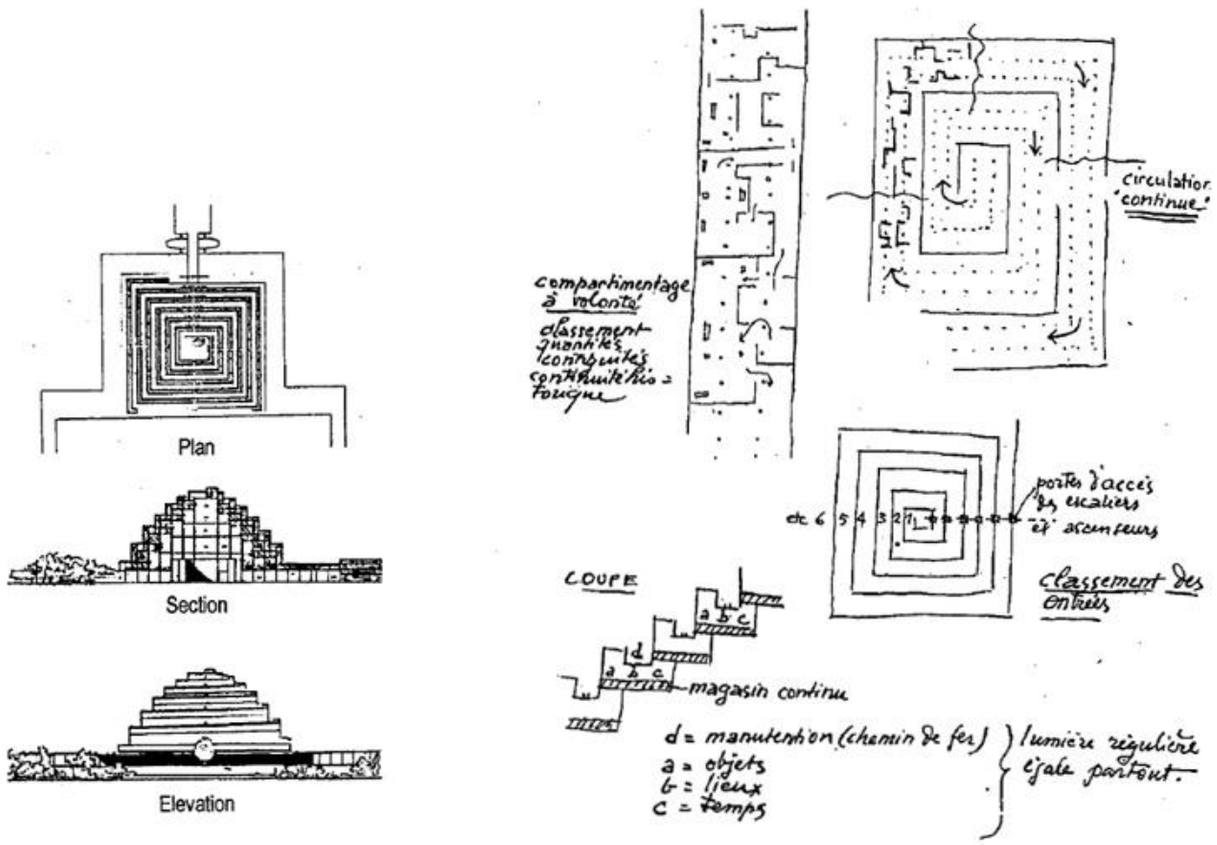
REF: Time Savers Standards (TSS)

- Museums of the modern movement reflected the 'modern' ideals, such as "form follows function", and "transparency" in materials and functional boundaries.
- These ideals have re-introduced museum design by suggesting that an interior can be
  - Open Plan Museum: Merely defined with circulation space (form follows function)
    Example: Le Corbusier's "Museum of Unlimited Growth"
  - Flexible Plan Museum: Divided by only a few partitions in a rectangular volume (transparency)
    Example: Mies Van der Rohe's "New National Gallery"

➢ Open Plan Type Museum

- In 1929 Le Corbusier designed a model of unlimited growth Museum (Musée à croissance illimitée) for Mundaneum of Geneva



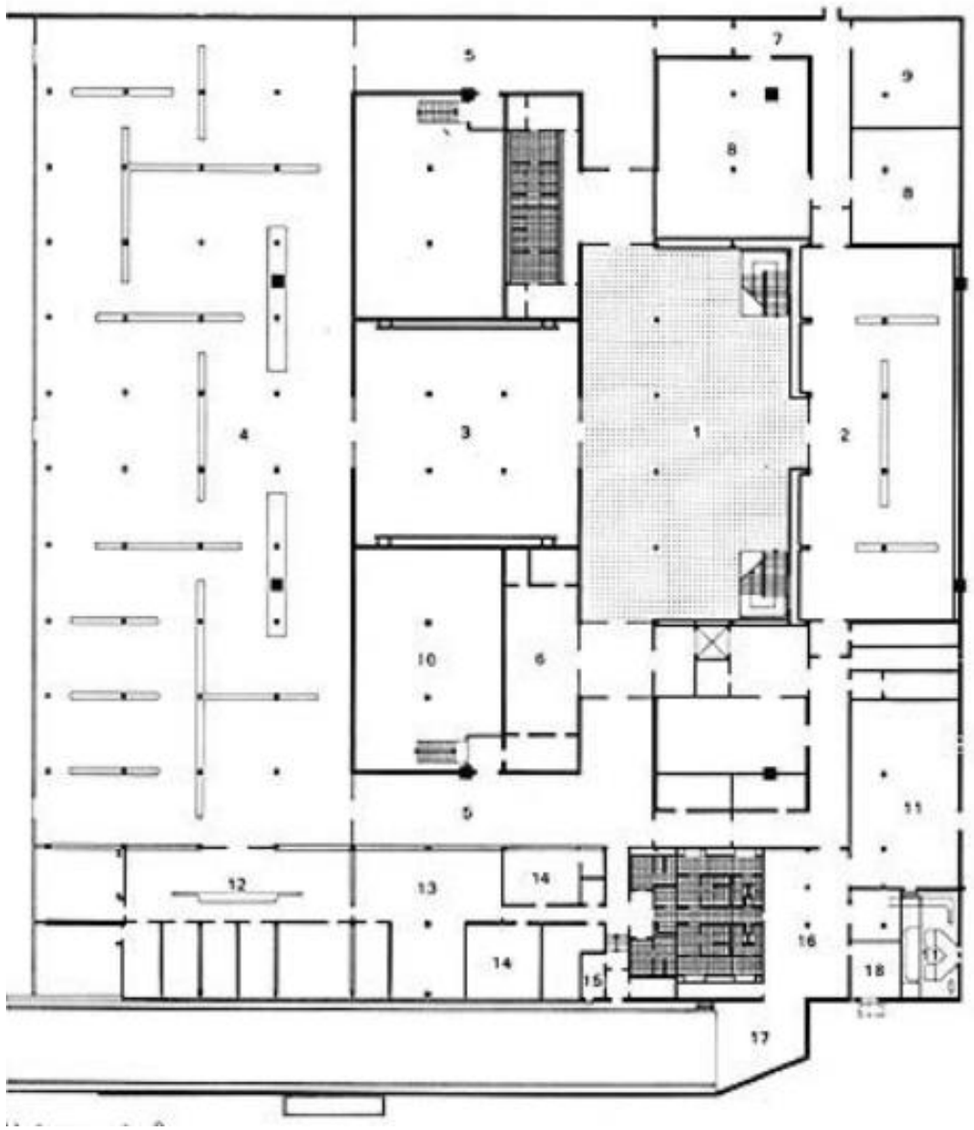


MUSEUM OF UNLIMITED GROWTH, GENEVA

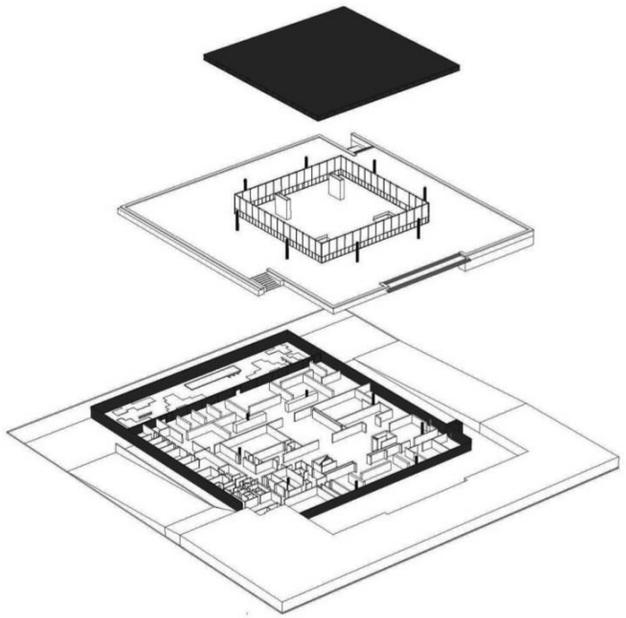
- It was a square spiral, on one floor supported by stilts, which would eventually evolve and grow according to the needs of the project.
- There are three versions of this type of museum in the world by architect: Kendra in Ahmedabbad (1957), the Museum and Art Gallery in Chandigarh Government (1965) and the National Museum of Western Art in Tokyo (1959).

REF: Study of the Ann Arbor Hands-on Museum, Ipek Kaynar, University of Michigan, USA

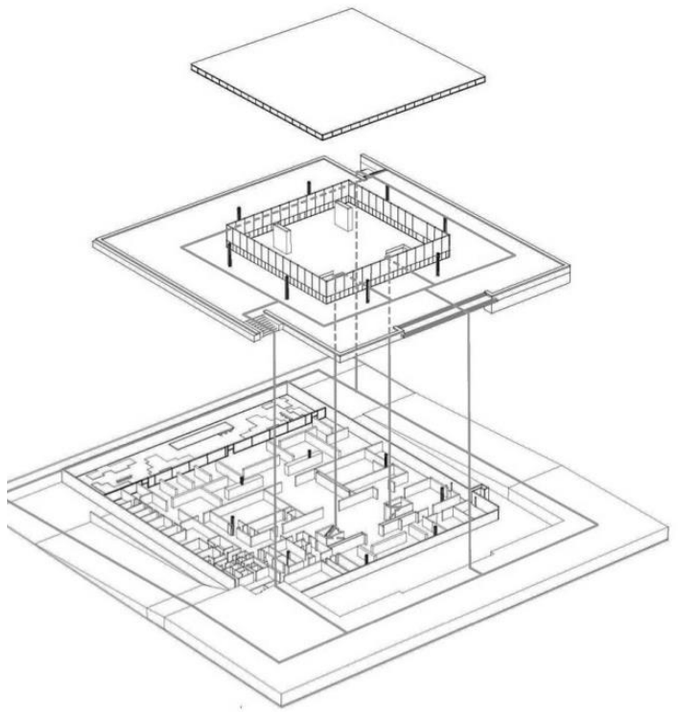
- ✓ New National Gallery
  - This work was a new way of thinking and understand a museum, away from the closed building composed of building theme rooms.
  - The building contains elements of walls that vary with different exhibits and limiting the visual continuity.
  - This building is from 1968, and it´s a jump from the traditional museum idea of a closed building with exhibition rooms, into an open-plan flexible space.



NEW NATIONAL GALLERY, BERLIN



The Structural Detail



The Circulation through the museum

REF: Study of the Ann Arbor Hands-on Museum, Ipek Kaynar, University of Michigan, USA

BYE LAWS AND STANDARDS

CONTENTS

WHAT ARE STANDARDS ? WHY ARE THEY IMPORTANT AND WHY DO WE FOLLOW THEM ?

Standards are documenting agreements containing technical specifications to be used consistently as rules , guidelines ,characteristics to ensure that materials , products , processes and services are fit for their purpose .

- Building standards address many of a society's most important concerns, including public health and safety, and environmental protection.
- Because they are developed by a democratic and deliberative process that applies improvements incrementally, the building codes also address cost efficiency and investment value.
- In large part, building codes establish a building's quality, safety and energy performance for years to come, because initial design and construction decisions determine operational and maintenance costs for the life of the building.
- Building equipment and other components may be replaceable and upgradeable, but many aspects of building performance are "designed in" at the beginning, and are too expensive and difficult to change.
- Foundations and other parts of the building envelope are typically in place for 50 years or more. Building codes and design and construction decisions affect us every day.
- Some requirements such as fire safety codes and structural and seismic standards affect us in obvious ways.
- Others, such as lighting quality, acoustics and the air we breathe also have major effects on our health and productivity.

TYPES OF STANDARDS :

- ✓ CURRENT STANDARD
- ✓ BASIC STANDARD

- CURRENT STANDARD : THIS STANDARD IS USED OVER A SHORTPERIOD OF TIME AND IS RELATED TO CURRENT CONDITIONS .
- BASIC STANDARD : THIS STANDARD IS USED OVER A LONG PERIOD OF TIME , FROM WHICH A CURRENT STANDARD CAN BE DEVELOPED .

STANDARDS AND CIRCULATION SPACES :

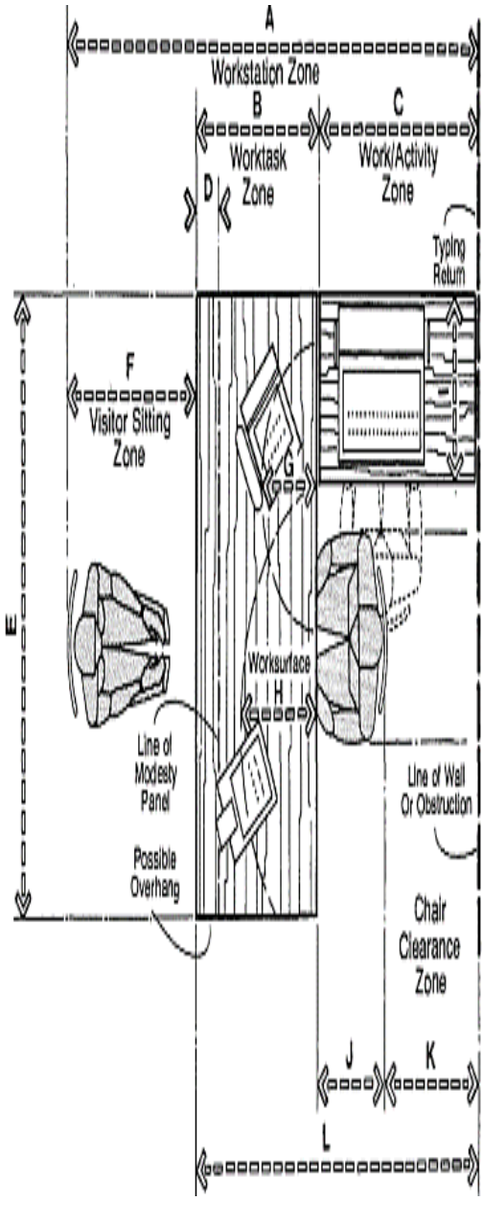
- MAIN ENTRY AND EXIT
- PARKING
- RECEPTION , LOBBY SPACE
- STAIRCASE , LIFTS AND CORRIDORS
- WASHROOMS
- STORAGE ROOM
- EXHIBITION AREA
- DISPLAY AREA
- LIBRARY
- LECTURE HALLS AND SEMINAR ROOMS
- CONFERENCE ROOMS
- CAFE AND RESTAURENTS
- KITCHEN AND PANTRY
- FIRE EXIT

ADMINISTRATION BLOCK:

- RECEPTION:

Closed plan offices have full height walls or partitions dividing the space into offices with doors are typically located along the window wall. The advantages include a controlled environment, security, visual privacy, physical separation, external views add traditional and systems furniture applications.

DETAILS OF RECEPTION AREA AND WAITING AREA



	in	cm
A	90–126	228.6–320.0
B	30–36	76.2–91.4
C	30–48	76.2–121.9
D	6–12	15.2–30.5
E	60–72	152.4–182.9
F	30–42	76.2–106.7
G	14–18	35.6–45.7
H	16–20	40.6–50.8
I	18–22	45.7–55.9
J	18–24	45.7–61.0
K	6–24	15.2–61.0
L	60–84	152.4–213.4
M	24–30	61.0–76.2
N	29–30	73.7–76.2
O	15–18	38.1–45.7

	in	cm
A	40–48	101.6–121.9
B	24 min.	61.0 min.
C	18	45.7
D	22–30	55.9–76.2
E	78 min.	198.1 min.
F	24–27	61.0–68.6
G	36–39	91.4–99.1
H	8–9	20.3–22.9
I	2–4	5.1–10.2
J	4	10.2
K	44–48	111.8–121.9
L	34 min.	86.4 min.
M	44–48	111.8–121.9
N	54	137.2
O	26–30	66.0–76.2
P	24	61.0
Q	30	76.2
R	15–18	38.1–45.7
S	29–30	73.7–76.2
T	10–12	25.4–30.5
U	6–9	15.2–22.9
V	39–42	99.1–106.7

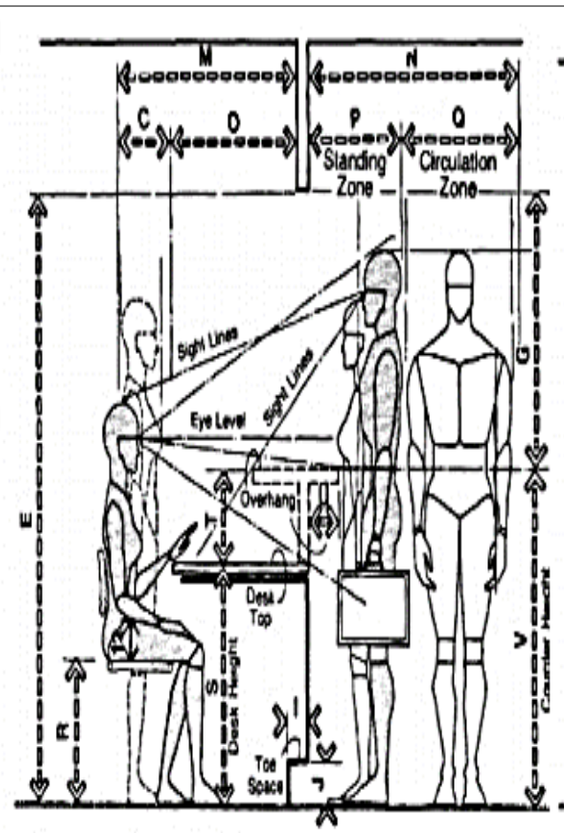


Fig. 2 Receptionist's workstation/desk height.

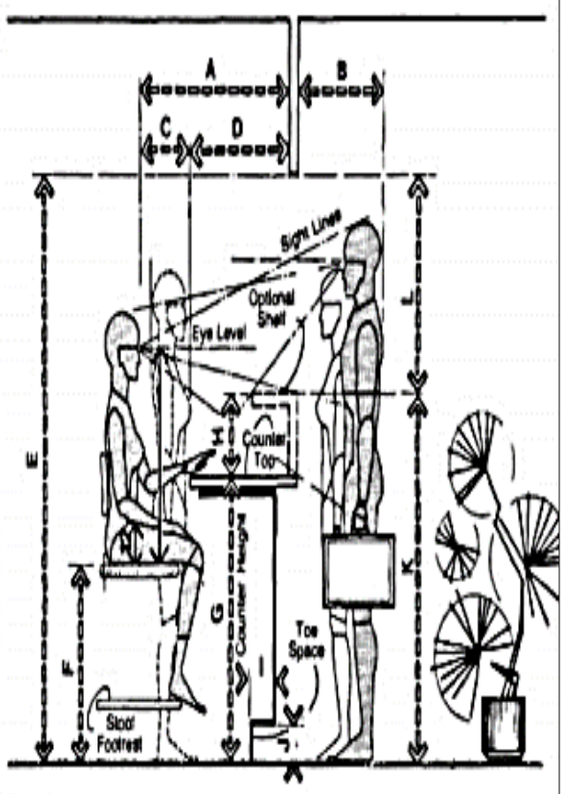
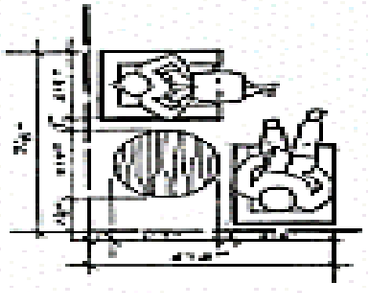
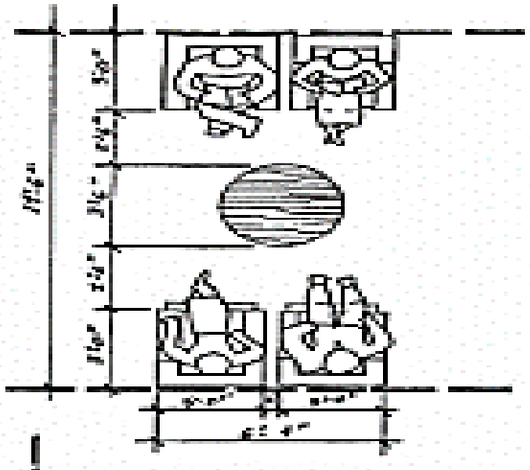
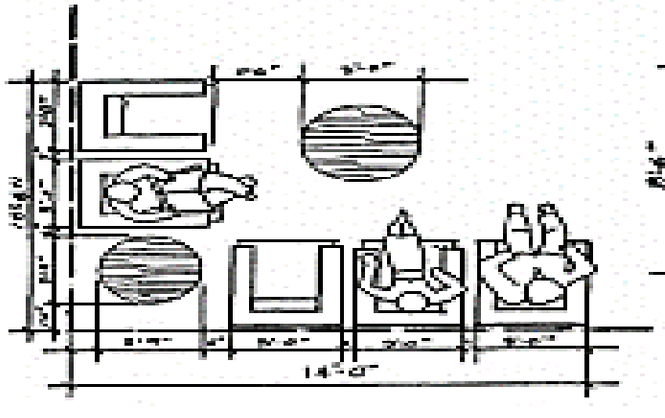
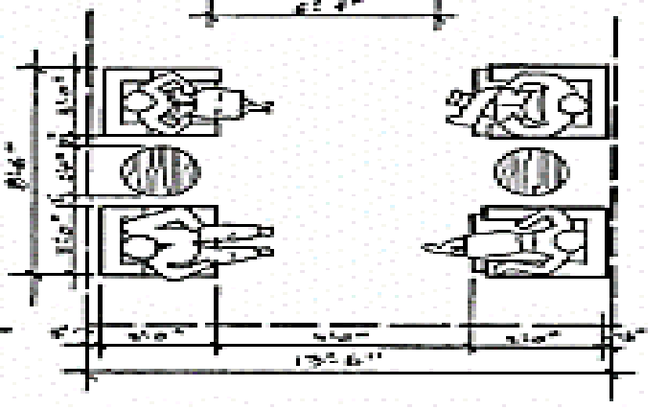


Fig. 1 Receptionist's workstation/counter height.



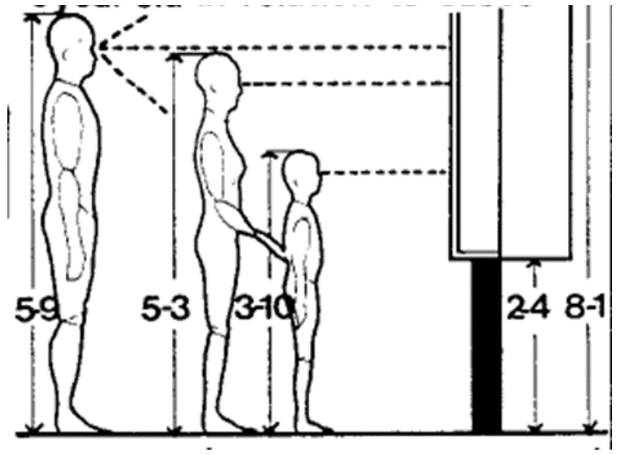


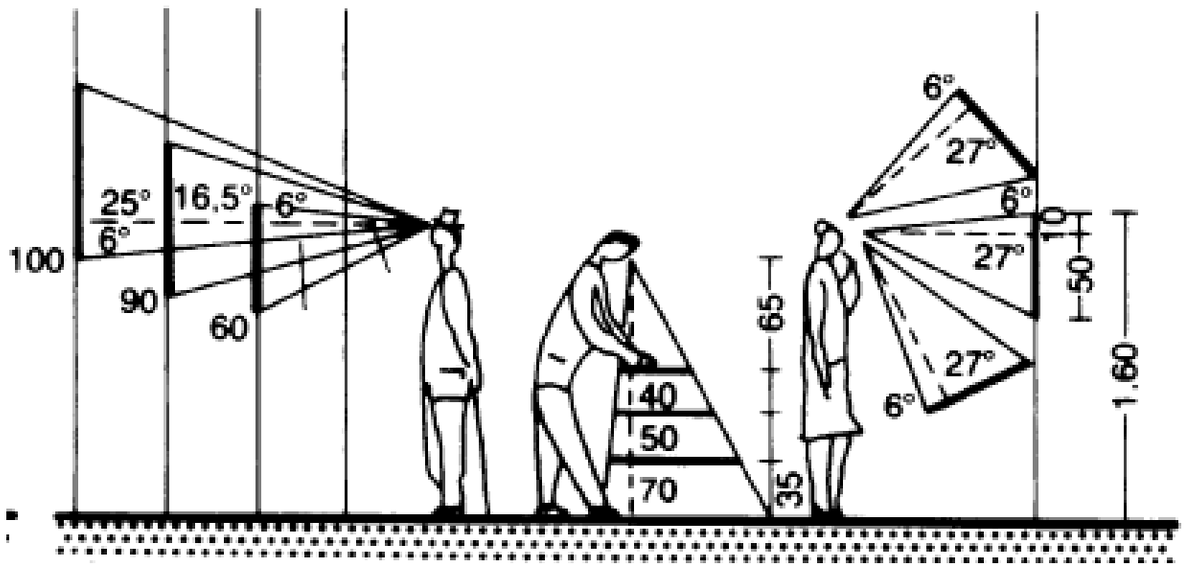




EXHIBITION HALLS AND GALLERIES:

- It should be remembered that the usual custom is to set aside for these purposes and area which may be as much as 50 percent of the total space available.
- In small museums this proportion may be reduced. But the fact remains that two conflicting needs have to be reconciled: on the one hand there must be easy communication between the public rooms and the museum services, since this makes for smooth relations between visitors and staff; on the other hand it must be possible to separate these two sections, so that they can function independently at any time.





- This is necessary chiefly to safeguard the collections et times when the building is closed to the public while the curators or office staff are still at work end the library and lecture hall in use.

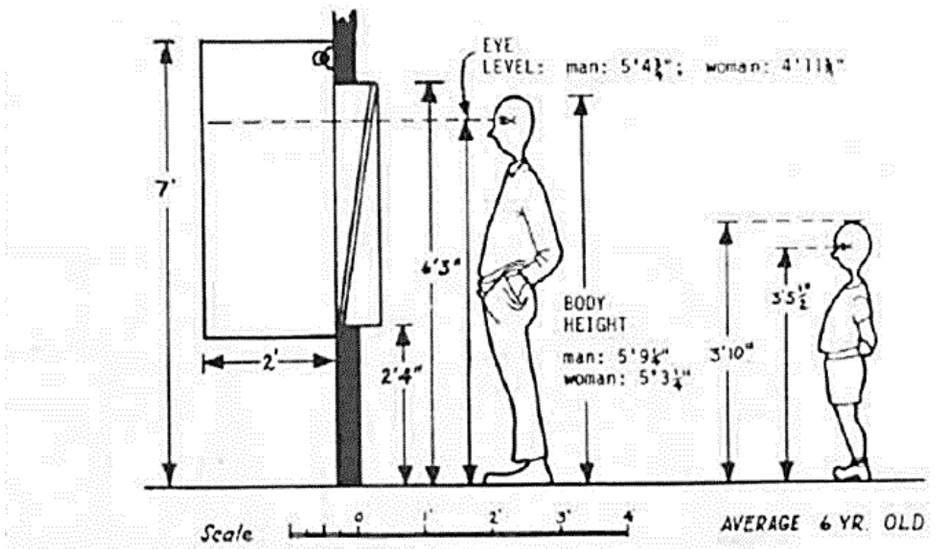


Fig. 4 Measurements of adult and six-year-old visitors in relation to cases.

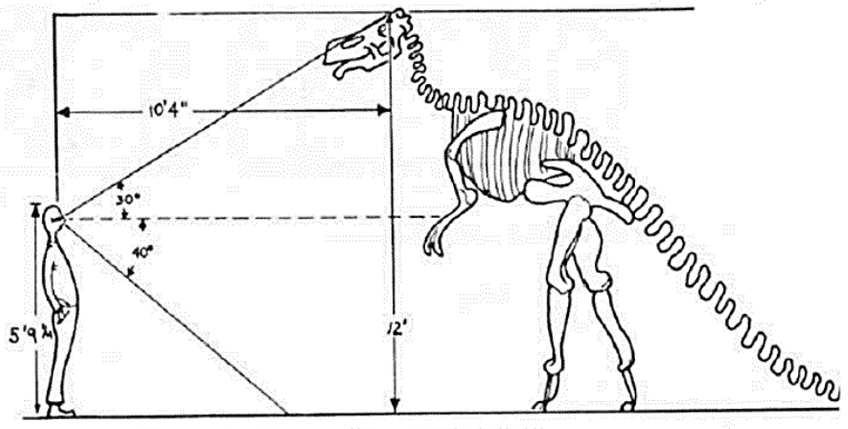


Fig. 6 Viewing distance should increase with greater size of object.

TYPES OF DISPLAYS:

- ✓ If the cases are arranged with gently curving lines to take advantage of this pattern of movement visitors will find the room more attractive and can progress easily with the line of the case.

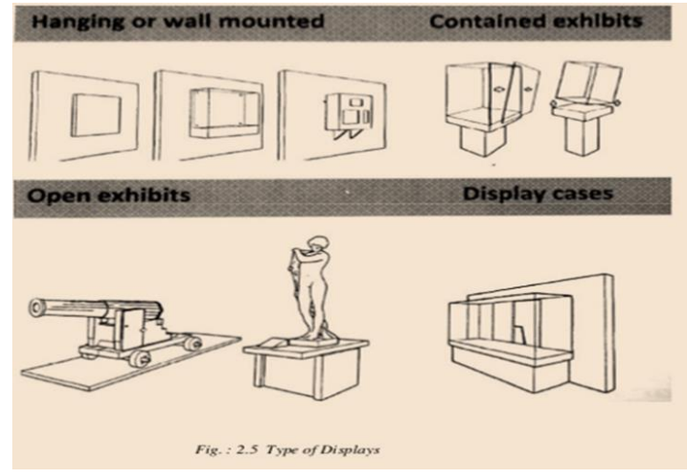
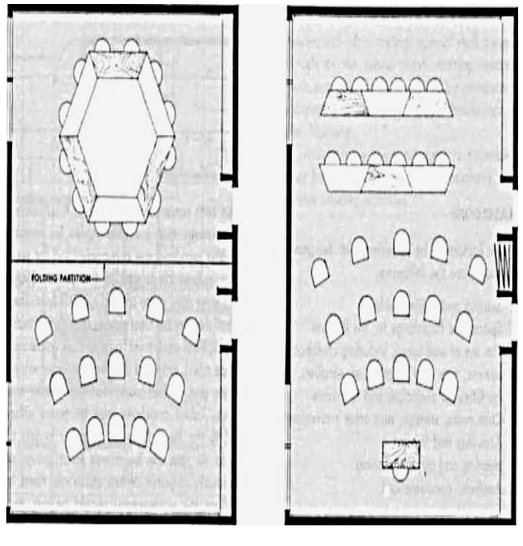
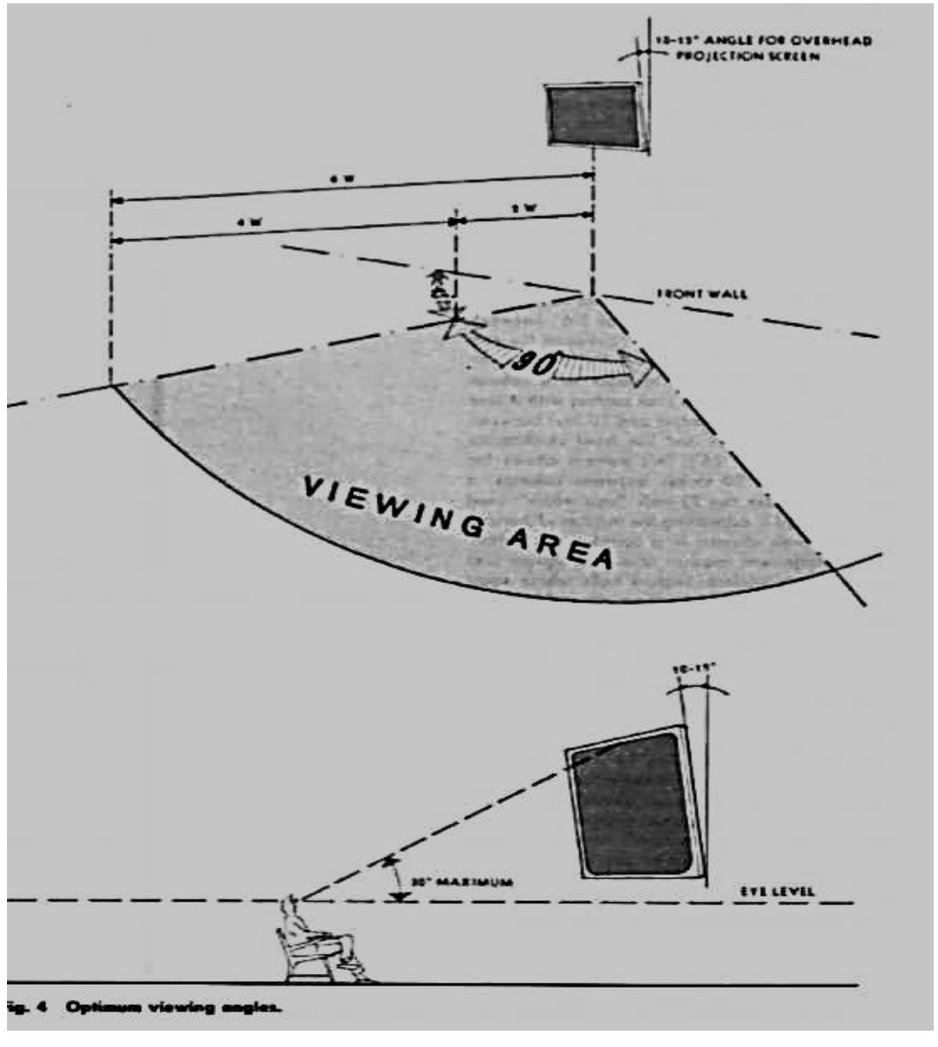


Fig. : 2.5 Type of Displays

LECTURE HALLS ,SEMINAR ROOMS

- The room itself should be arranged so that the audience can see well, hear well, and be comfortable. In part this depends on temperature, humidity, background of light and sound, and seating space.
- If lecture rooms are built in a fan shape instead of a rectangular shape, the minimum angle between line of sight and the blackboard should be at least 30 degrees and preferably more than 45 degrees. These limitations of viewing distance and angle impose restrictions on the placement of seats for adequate viewing .
- The angle of elevation from the eye to the upper part of an object on the screen or chalkboard should not exceed 30 degrees .

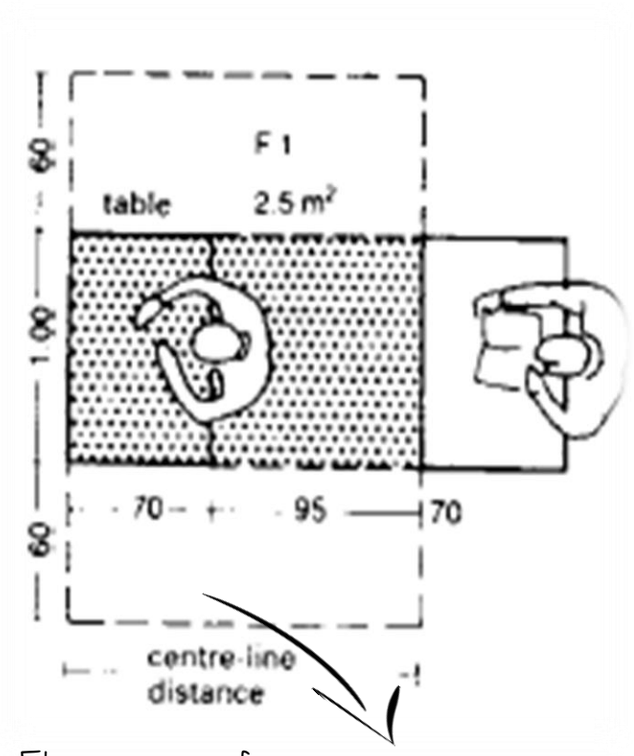




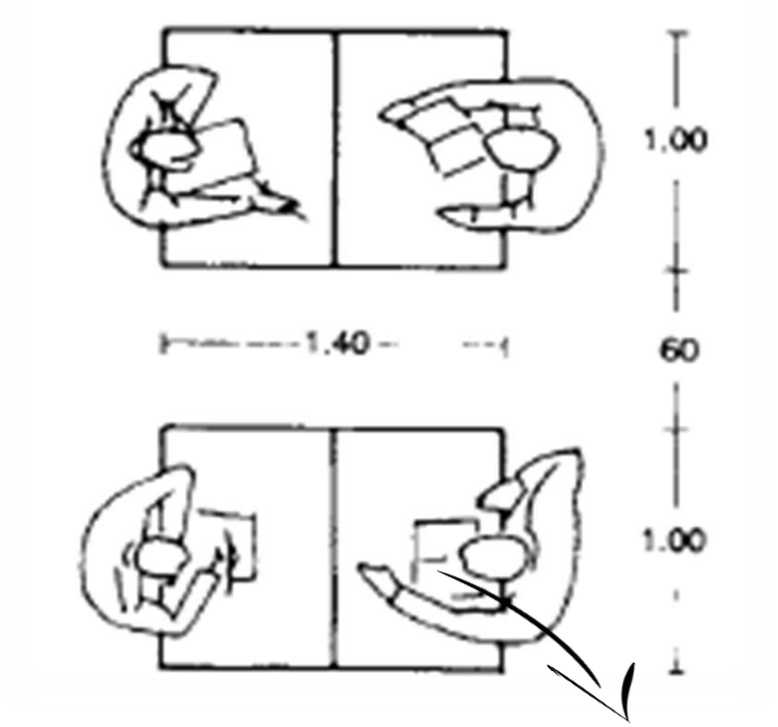
ig. 4 Optimum viewing angles.

LIBRARY

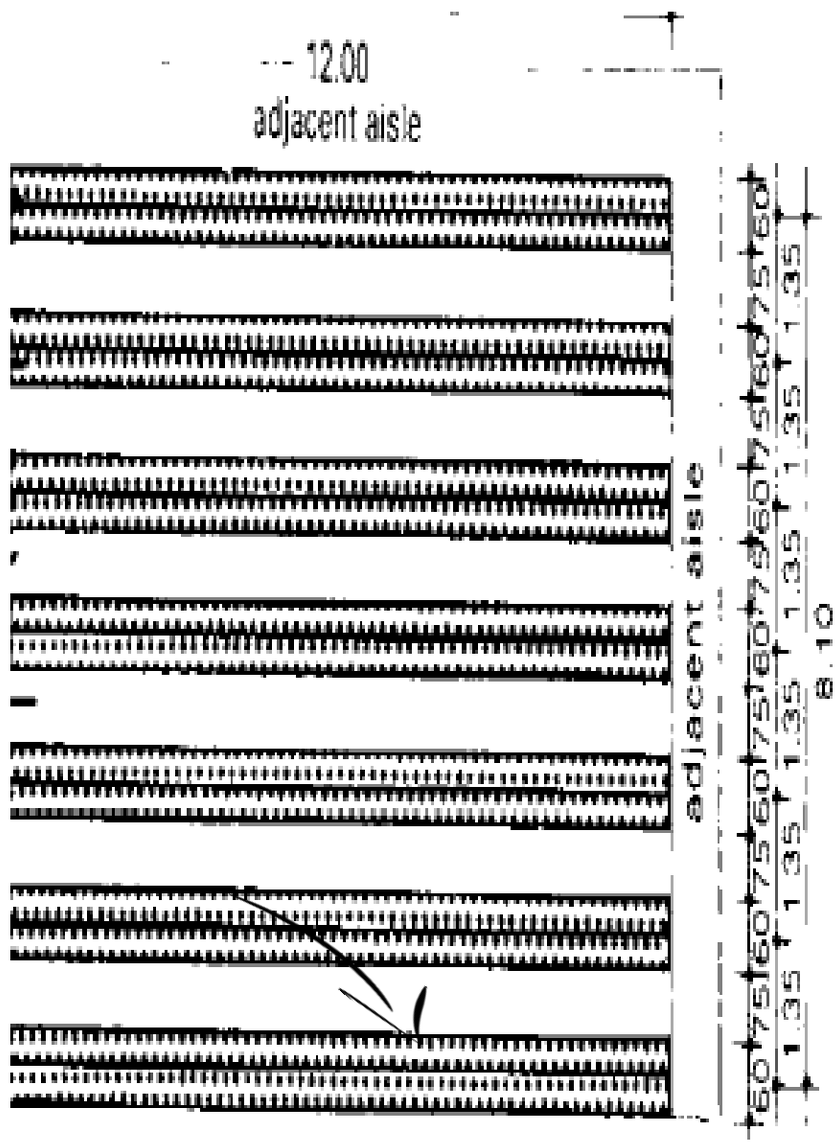
- Libraries perform a range of function in society. Museum libraries, obtain, collect various study on history, architecture etc



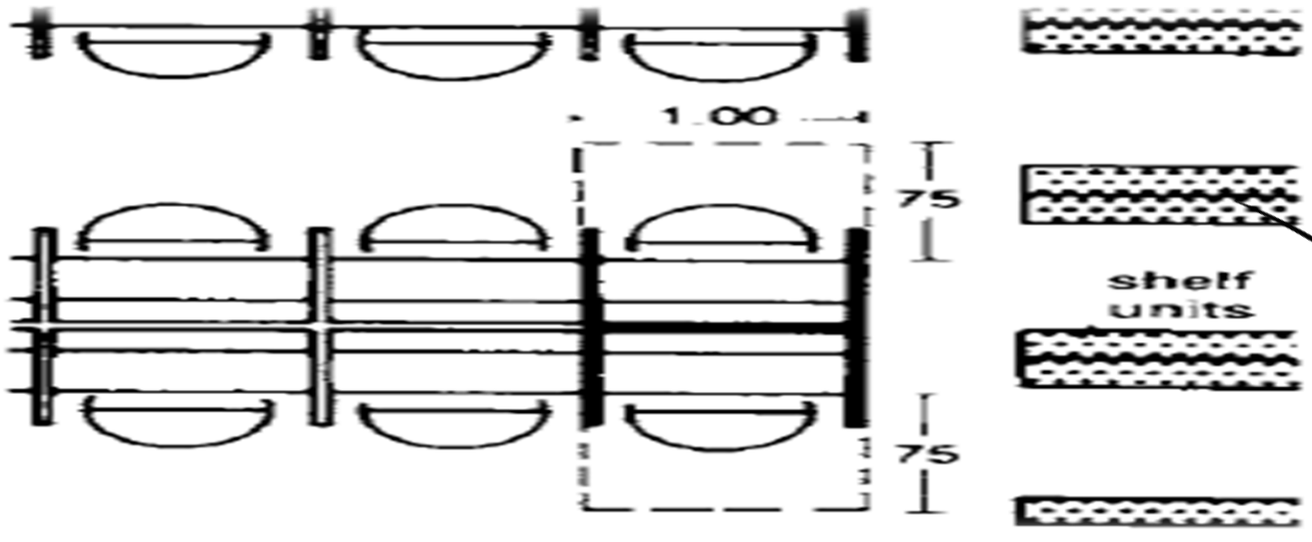
Floor area for an individual work station



Minimum distance between tables



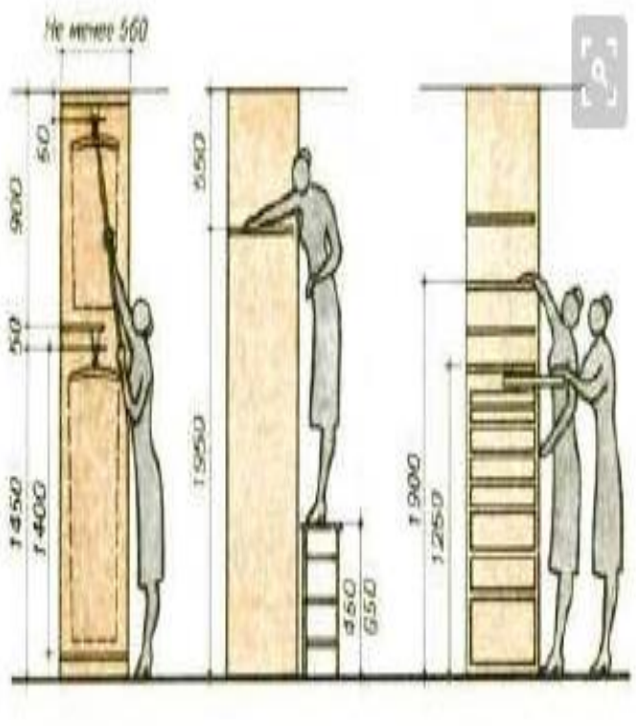
Floor space for book shelves in area closed to public



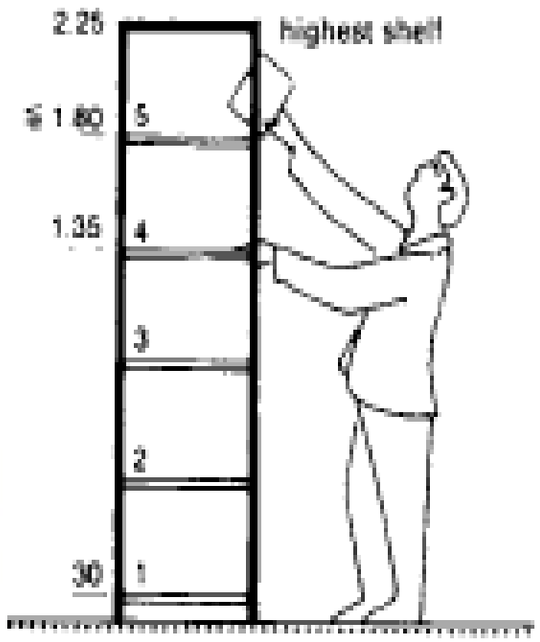
Micro fiche reading workstation

SHELVING UNITS

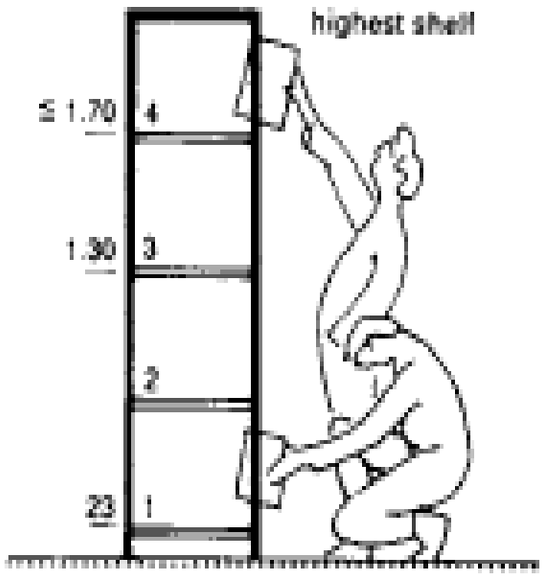
- Most widely used type is metal shelving, individually adjustable, single sided (along walls) and double sided (island). Unit height 2000 (loan area), 2300 (block stock areas) main routes in open space areas 1800 clear width and minor routes 1200.



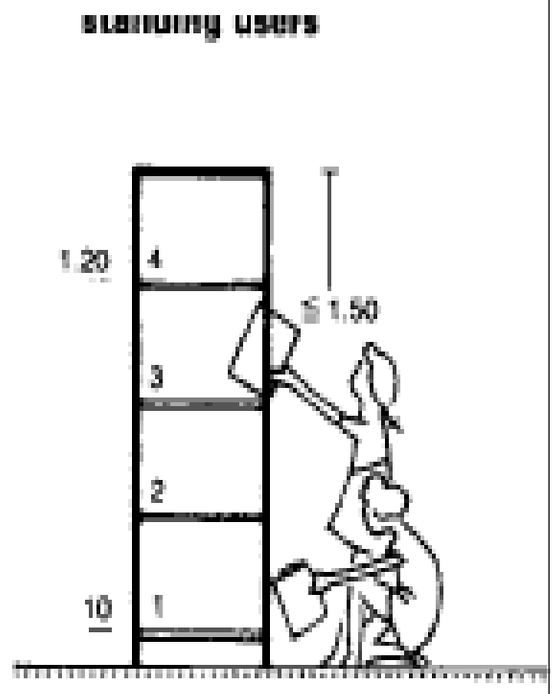
Shelves for adults



Height of 5 shelf unit

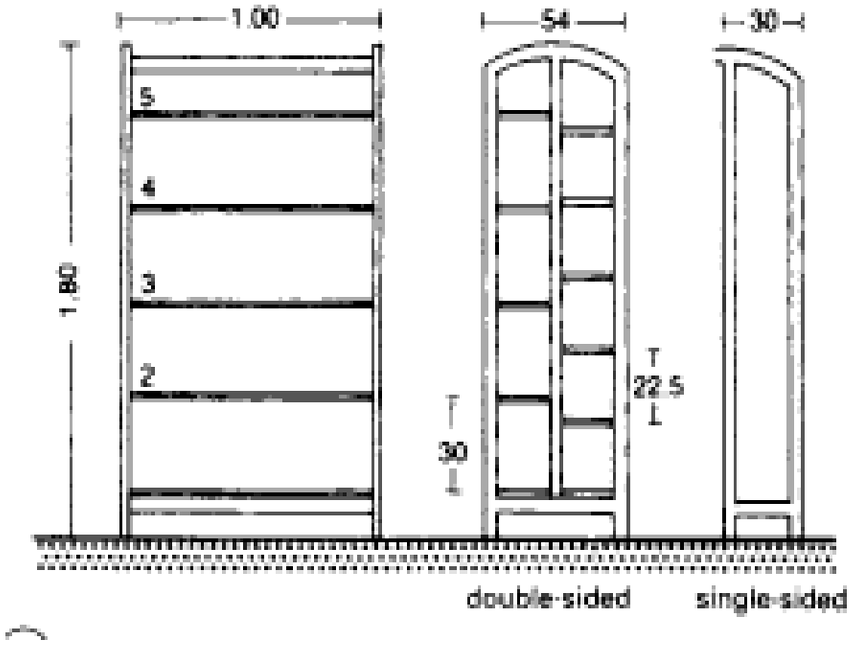


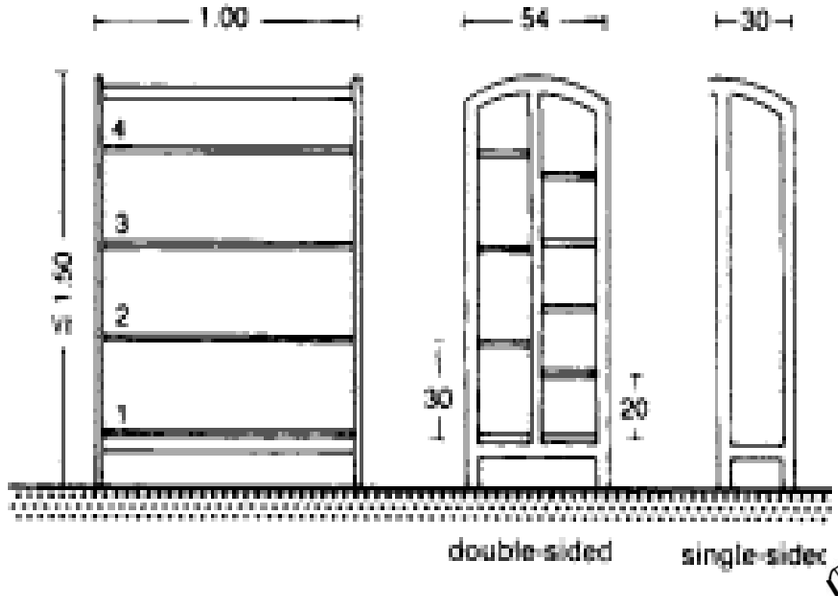
Book shelf for school children



Height of 4 shelf unit for small children

Shelves for children

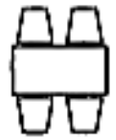
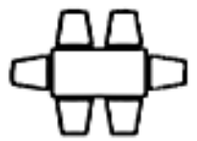
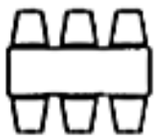




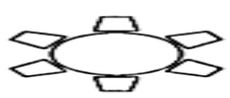
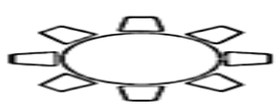
CAFES AND RESTAURANTS:

- Seating areas and table arrangements .There are significant differences in seating arrangements depending on:
- Types of customer: price level, expectations
- Type of establishment: self-service, waited service, counter seating
- Grouping: table sharing, flexibility of arrangement
- Room characteristics: shape, obstructions, windows. Furniture falls into four categories:
- Fitted counters or bars
- Fixed tables, usually pedestal or cantilevered
  Movable tables, with legs or pedestals
  Stackable tables
  - Cafeterias are self-service establishments, commonly run on a non-commercial basis as a service to staff and others such as students.
  - They are characterised by:

Scale of operation: usually fairly large, giving certain economies of scale .

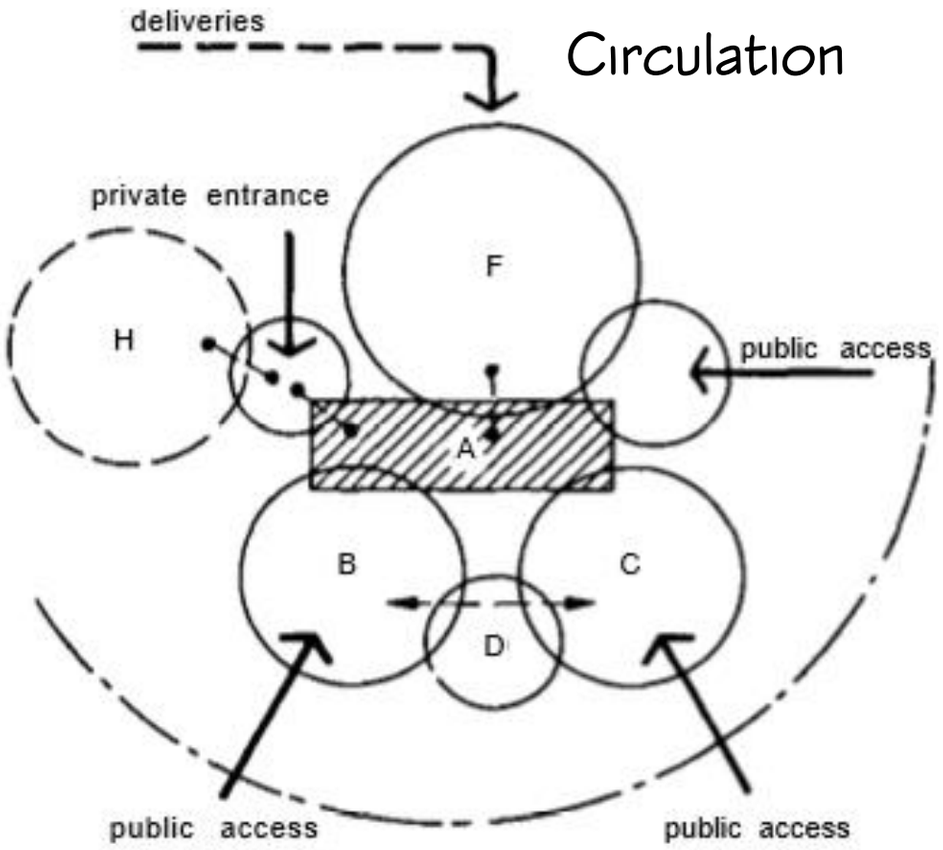
number of seats	table size: drinking mm	table size: eating mm
1 	450 to 600	600 to 700
2 	600 square	750 square
4 	750 square	900 x 950
	–	1500 x 750
6 	–	1400 x 950
	–	1700 x 750
8 	–	1750 x 900
	–	2300 x 750

Recommended rectangular table sizes relating to place ers

number of seats	table size: drinking mm	table size: eating mm
1 	450 to 600	750
2 	600	850
4 	900	1050
6 	1150	1200
8 	1400	1500

REASTAURANT SEATING

Circulation



18.37 *Space relationship diagram for a public house*

A *Servery*

B, C *Drinking rooms*

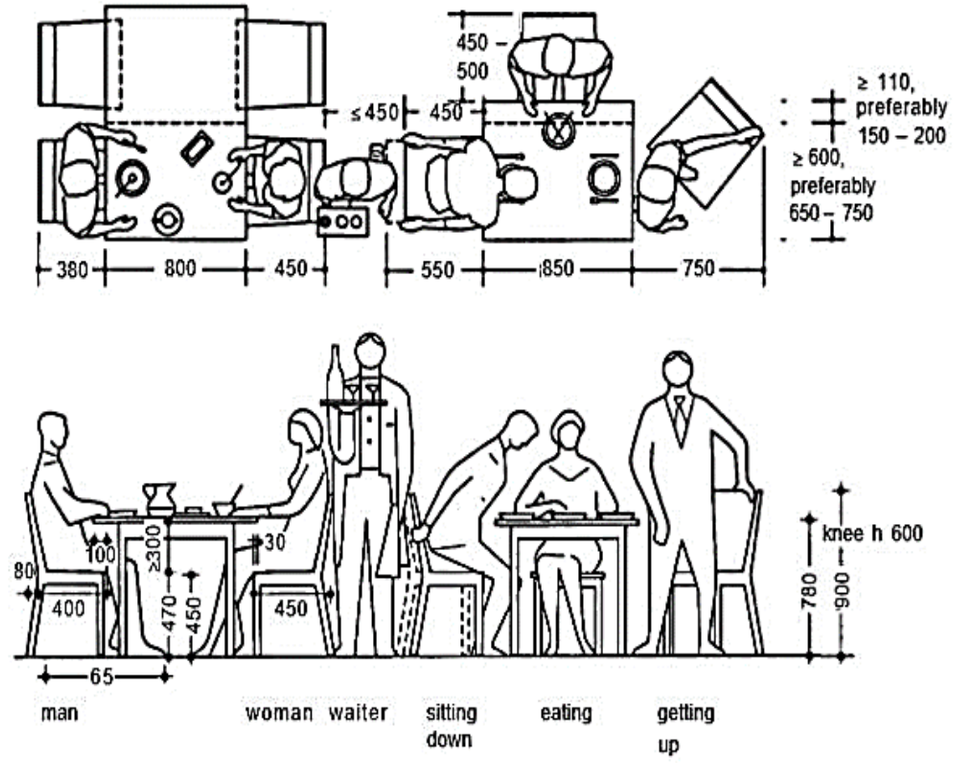
D *Lavatories*

E *Off-sales*

F *Storage (cellars)*

G *Licensee's entrance*

H *Licensee's accommodation*



18.8 *Restaurant critical dimensions*

Toilet

Table: -5.12 Sanitation Requirements for Assembly Occupancy Buildings (Art, Galleries, Libraries and Museums)

Sl. No.	Sanitary Unit	For Public		For Staff	
		Male	Female	Male	Female
1	Water Closet (W.C.)	One for 200 persons upto 400 persons. For over 200 persons, add at the rate of 1 per 250 persons or part thereof	One per 100 persons upto 200 persons. For over 200 persons, add at the rate of 1 per 150 persons or part thereof	One for 1-15 persons. Two for 16-35 persons	One for 1-12 persons. Two for 13-25 persons
2	Ablution Taps	One in each W.C.	One in each W.C.	One in each W.C	One in each W.C
3	Urinals	One for 50 persons or part thereof	--	Nil upto 6 persons One for 7-20 persons Two for 21-45 persons	--
4	Wash Basins	One for every 200 persons or part thereof. For over 400 persons, add at the rate of 1 per 250 persons or part thereof.	One for every 200 persons or part thereof. For over 200 persons, add at the rate of 1 per 150 persons or part thereof	One for 1-15 persons Two for 16-35	One for 1-12 persons Two for 13-25 persons
5	Cleaner's Sink	One per floor, minimum			
6	Drinking Water Fountain	One per 100 persons or part thereof			

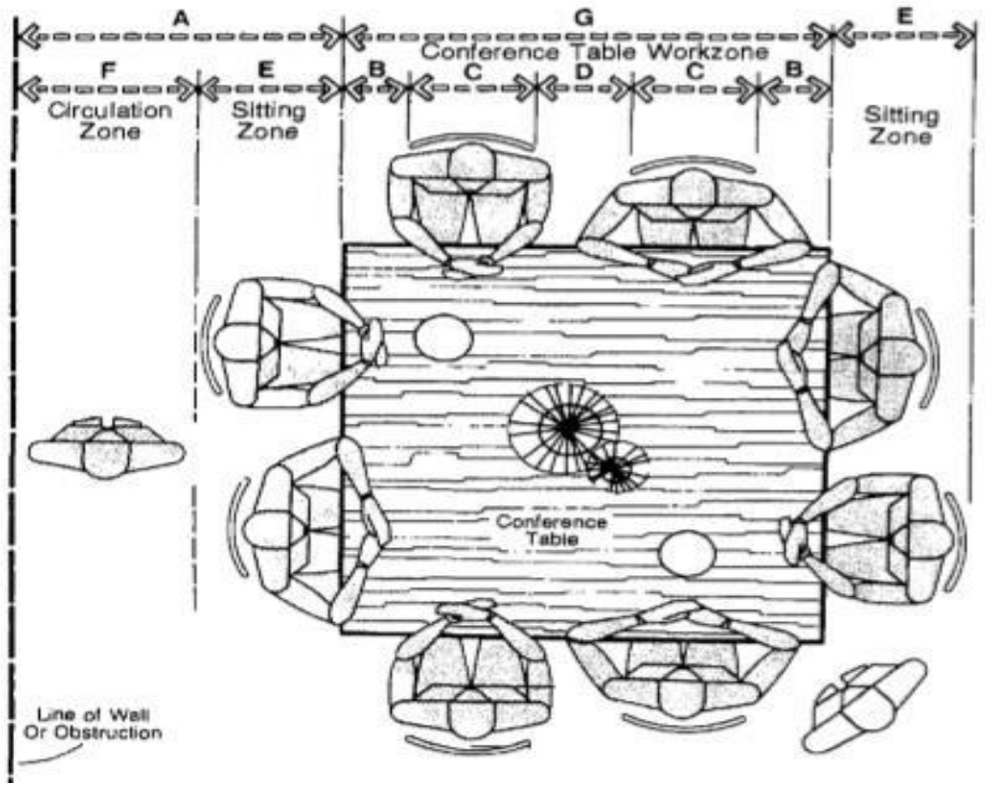
Note: It may be assumed that two thirds of the numbers are males and one third females.

VISITORS CONTROL:

- Visitors receive the first impression of an organization from the décor and layout of the reception area. It should be attractive,nest,business like and above all ,adequate to accommodate normal visitor traffic.
- An allowance of 0.9sq.m pr each visitor to be served may be used for space allocation.
- Individual seats are preferred over sofas
- Corner seating arrangements must always consider leg clearance.
- Circulation between low tables and the edges of chairs must be adequate to allow for the legs of persons seated in the chairs.
- Convenient location for side tables. So that magazines,artwork,portable lighting can be placed on them , which are important.

CONFERENCE REQUIREMENTS:

- Conference spaces are private offices or the conference rooms.
- In large offices it is desirable to provide a conference room adjoining the office of a top official and early conference rooms for official with more limited requirements.
- Separate conference rooms permit maximum utilization through scheduling at an appropriate level of management.



LOCATION OF CONFERENCE ROOMS:

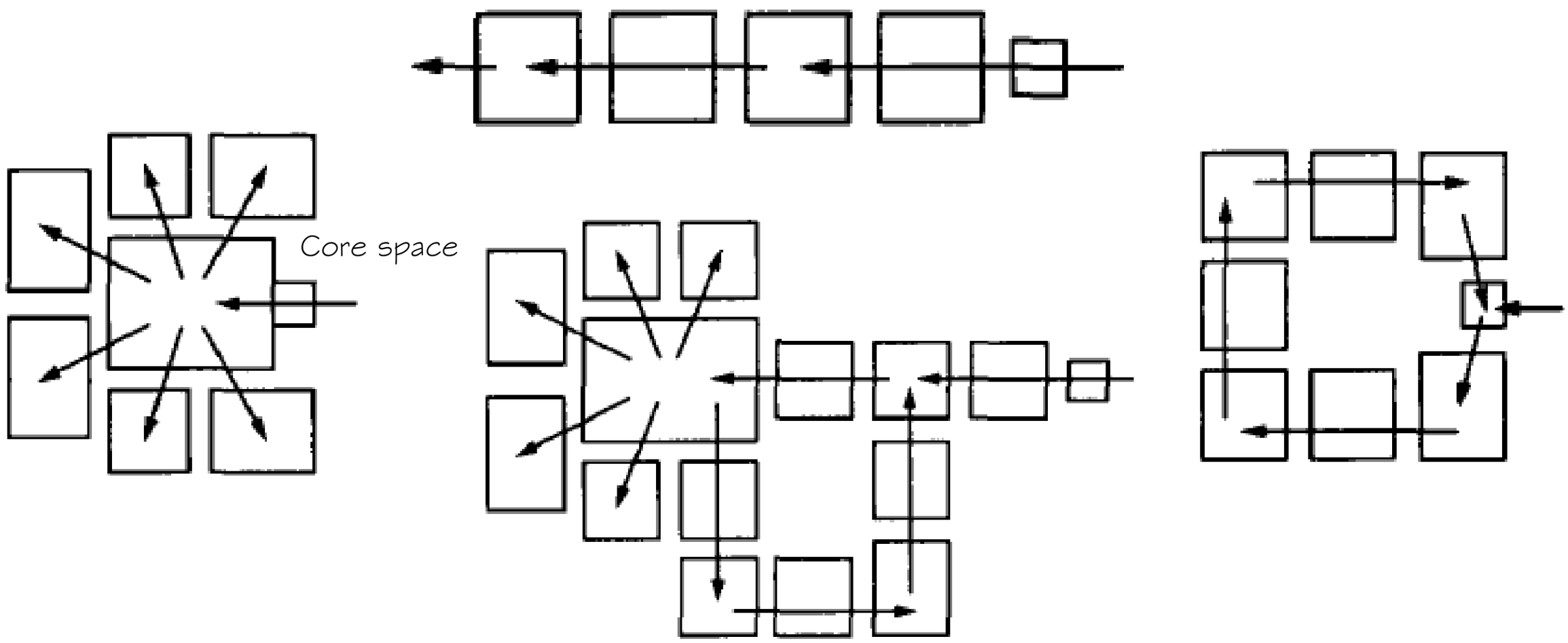
- Conference room should be centrally located to the users.
- An interior space which is not most desirable for office purposes, is well suited for conference use.
- The location eliminates outside distraction and the needs for window coverings during visual presentations.
- Access in conference rooms should be through corridors and through reception areas.

SIZES OF CONFERENCE ROOMS

- Conference rooms should be designed to accommodate average but not maximum attendance. Extra chairs can be used to achieve additional seating.

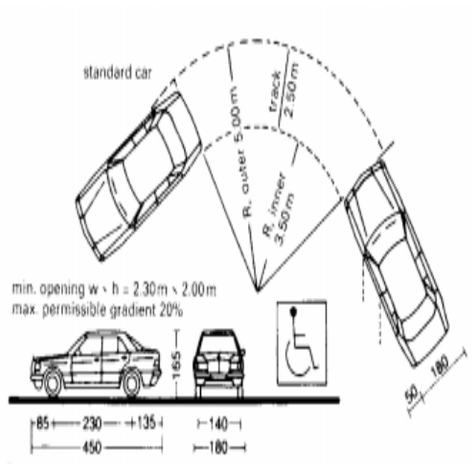
CIRCULATION SPACES

- Widen corridors beyond the typical 8-9 feet currently in use .
- Corridors should be able to easily handle two way traffic.
- Break up corridor lengths . This will reduce travel time and also discourage kids from running through the halls.

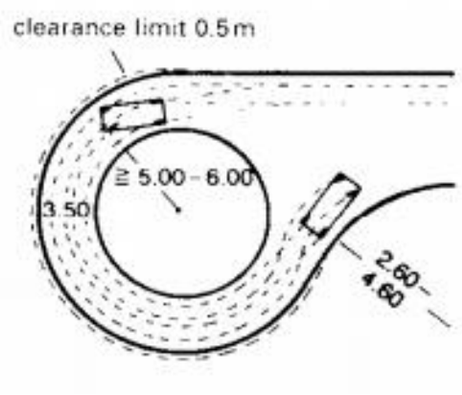


PARKING

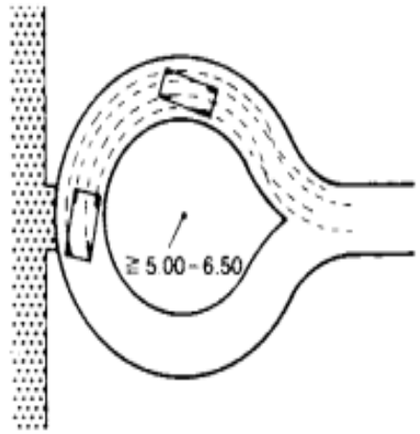
- The type, size and shape of a turning place in a road depends on the road use in that particular area. Parking stalls should be built to accommodate larger cars. The larger cars have on over-all length of 5.7m over -all width of 2.5m. The ramp angle must not exceed 7°. The limit of the front approach angle is 14°.



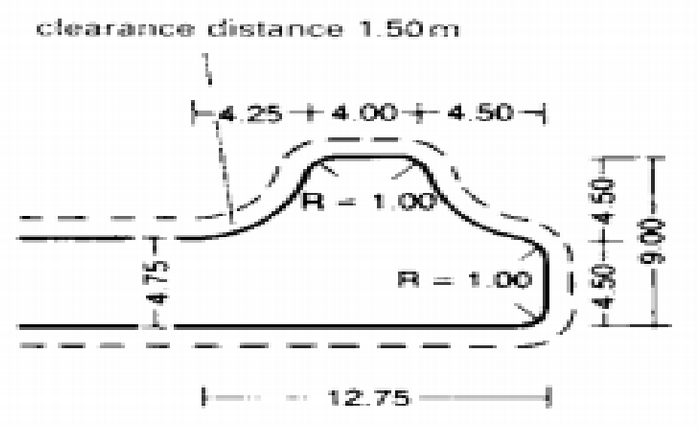
STANDARD CAR



CAR TURNING CIRCLE



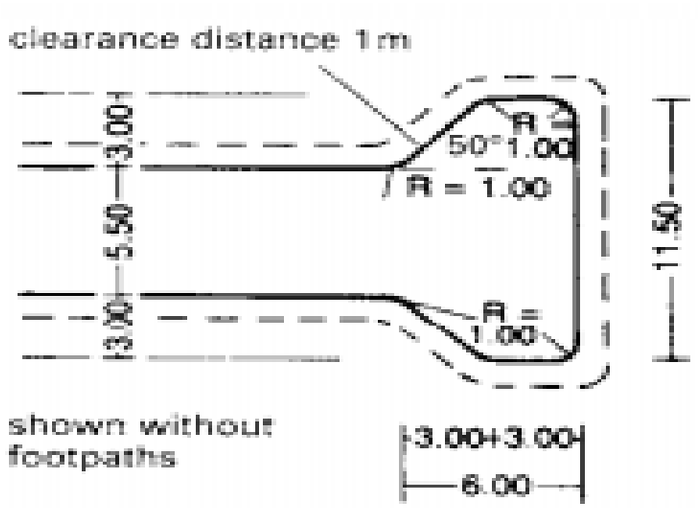
CAR TURNING CIRCLE RADIUS FOR AN ENTRANCE DRIVE >OR EQUAL TO 5-6.50M



HAMMER HEAD TURNING SPACE FOR CARS

PARKING SPACE STANDARDS FOR AUDITORIUM:

TYPES	LENGTH	WIDTH	NO.OF VECHILES
CARS	4.35	1.65	45% of total capacity of auditorium
SCOOTERS	2.03	1.06	10% of total capacity of auditorium
CYCLES	1.91	0.53	25% of total capacity of auditorium



HAMMERHEAD TURNING SPACE FOR VEHICLES UPTO 8M (REFUSE COLLECTION VEHICLES,FIRE TENDERS,TRUCKS UPTO 6T)

ACCORDING TO GO No. 168

REQUIREMENT OF APPROACH ROAD FOR BUILDING SITES / PLOTS :

The minimum abutting existing road width required for various uses of building activities shall be as given below.

TABLE - II

Category	Type / Use of Building Plot permissible	Minimum abutting existing road width required (in meters)
B	**SITES IN NEW AREAS / APPROVED LAYOUT AREAS**	
B 1	Non-High Rise (Residential) Buildings including Group Housing (Cellar and / or Stilt as permissible + maximum up to 5 floors), Basic level social amenities like Nursery School,	9 **

5. PERMISSIBLE SETBACKS & HEIGHT STIPULATIONS FOR ALL TYPES OF NON-HIGH RISE BUILDINGS

(Buildings below 18m in height inclusive of Stilt / Parking Floor):

(a) The height of buildings permissible in a given site / plot shall be subject to restrictions given in **Annexure - I to II**.

(b) The minimum setbacks and permissible height as per **Table - III** and other conditions stipulated below shall be followed.

TABLE – III

Sl. No.	Plot Size (in Sqm) Above – Up to	Parking provision	Height (in m) Permissible Up to	Building Line or Minimum Front Setback to be left (in m)					Minimum setbacks on remaining sides (in m)
				Abutting Road Width					
				Up to 12 m	Above 12m & up to 18m	Above 18m & up to 24 m	Above 24m & up to 30m	Above 30m	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
11	Above 2500	Stilt + 2 or more Cellar floors	7	3	4	5	6	7.5	5.0
			15	3	4	5	6	7.5	6.0
			18**	3	4	5	6	7.5	7.0

Stilt Floor meant for parking is excluded from the permissible height in the previous Table.

- Height of stilt floor shall not be less than 2.5m.
- In case of parking floors where mechanical system and lift are provided, height of such parking floor shall not be less than 4.5m.

OTHER CONDITIONS:

- The setbacks are to be left after leaving the affected area of the plot / site, if any, for road widening.
- Where a site abuts more than one road, then the front setback should be insisted towards the bigger road width and for the remaining side or sides, the setback as at Column-10 shall be insisted.
- A strip of at least 1m greenery / lawn along the frontage of the site within the front setback shall be developed and maintained with greenery.

RESTRICTIONS ON PROJECTIONS IN MANDATORY OPEN SPACES:

The following are the Restrictions on Projections in the mandatory open spaces / setbacks / interior open spaces:

(a) Cornice, Chajjas / weather shades only of width not exceeding 60cm shall be allowed in the mandatory setbacks.

(b) No balcony projections or corridor shall be permitted projecting within the mandatory open spaces / setbacks in case of non-high rise buildings.

These, if provided for, shall be set back as per the minimum mandatory open spaces and the setbacks shall be clear from the edge of the balcony or corridor. However, a Portico or Canopy without access to the top may be considered in the front open space.

PARKING REQUIRMENTS

In all buildings provision shall be made for parking spaces as per the following requirements.

Category of building/ activity	Parking area to be provided as percentage of total built up area					
	HMDA Area		All Municipal Corporations & UDA Areas		Municipalities/ N.Ps/ G.Ps. other than UDA Areas	
	GHMC	Municipalities/ N.Ps/ G.Ps. in HMDA Area	All Municipal Corporations	Municipalities/ N.Ps/ G.Ps. in UDA Areas	Selection & Special Grade Municipalities	Other Municipalities/ N.Ps/ G.Ps.
2	3	4	5	6	7	8
Residential Apartment Complexes, Hospitals, Institutional buildings, Industrial buildings, Schools, Colleges, Other Educational Buildings & Godowns & Others	30	20	20	20	20	20

The parking spaces may be provided in:

- Basements or cellars (one or more) / multi-level (allowed for plots 750sq.m and above only) or
- The Open space over and above the setbacks i.e. after leaving the setbacks to be left around the building with adequate vehicular access, aisle, drives, ramps required for manoeuvring of vehicles, or

Cellar floor shall be used only for parking and not for any habitation purpose. There shall be ventilation to cellars with not less than 2.5% of each cellar floor area .

In the Stilt floor a watchman room and 2 toilets (W.C), with maximum built up area of 25sq.m may be allowed.

Such space shall not be disposed and shall be part of common facility of the complex.

For the sites above 750sq.m area it is permitted subject to fulfilment of parking requirement.

- ✓ For parking spaces in basements and upper floors, at least two ramps of minimum 3.6m width or one ramp of minimum 5.4m width and adequate slope 1 in 8 shall be provided. Such ramps shall not be allowed in mandatory setbacks including building line, however they may be permitted in the side and rear setbacks after leaving minimum 7m of setback for movement of fire-fighting vehicles. Access to these may also be accomplished through provisions of mechanical lifts.
- ✓ The minimum width of the drive way shall be 4.5m.
- ✓ In case where the permissible set back is less than 4.6m the pillars position in stilt floor shall be so designed that there shall be clear space of 3.6m (excluding Greenery) is available for movement of vehicles.
- ✓ Cellar shall be with a setback of at least 1.5m in the sites of extent of up to 1000sq.m, 2m in the sites of extent of more than 1000sq.m and up to 2000sq.m, and 3m in the sites of extent of more than 2000sq.m from the property line. In case of more than one cellar, 0.5m additional setback for every additional cellar floor shall be insisted.
- ✓ Up to 10% of cellar may be utilised for utilities and non-habitation purpose like A/C Plant room, Generator room, Sewerage Treatment Plant (STP), Electrical installations, Laundry, etc.
- ✓ Visitors' parking shall be provided with minimum 10% of the parking area and may be accommodated in the mandatory setbacks other than front setback where ever such setbacks are more than 6m (excluding green strip).How ever this is not permissible in case of transfer of setback. The Visitors' Parking facility shall be open to all visitors which shall be properly demarcated on ground .

MUSEUM FIRE SAFETY CONCERNS:

Here it is the content of the buildings which generally needs to be protected at all costs as many objects on show in museums are irreplaceable and consequently a monetary value cannot easily be placed on their loss: they are priceless. From a fire insurance point of view displaying priceless arti facts to the public demands the highest levels of security and fire protection. In other words we need to be prepared to make more compromises regarding the introduction of both passive and active measures to provide maximum fire protection. The less sensitive the building is to the introduction of physical protective measures, the more effective the protection can be made. Storing and exhibiting priceless objects in a priceless building is an extremely high-risk strategy.

Modern buildings are designed to provide maximum protection and enable all occupants to exit the building quickly and safely. However adapting a historical building is a much more difficult undertaking and a great many museums are still housed in historical buildings. It is estimated that less than 20% of museums are modern purpose-built structures, where the appropriate fire-protection building codes have been observed. Such buildings will be capable of providing first class protection including: · Fire compartmentalization · State-of-the-art fire detection and alarming equipment · Smoke control · Multiple exit routes · Tailored extinguishing systems .

FIRE-RESISTIVE REQUIREMENTS

EXTERIOR WALLS, COLUMNS AND BEAMS :

- Load bearing exterior walls shall be 3 hour fire resistance provided the building is protected with automatic sprinkler system.
- Columns and beams shall be 3 hour fire resistance provided the building is protected with automatic sprinkler system.
- Non-load bearing exterior walls shall be 2 hour fire resistance provided the building is protected with automatic sprinkler system .

INTERIOR WALLS

Exits are constructed as smoke proof enclosures;
Sprinkler control valves with supervisory initiating devices, and water flow initiating devices are provided on each floor .
Non-load bearing interior walls shall be permitted to have no fire resistance rating based solely on the specified construction type herein, provided the building is protected with an approved automatic sprinkler system.

PROTECTION OF OPENINGS

- Opening protection, where required, shall be fire resistance.

ELEVATOR LOBBIES

- Elevator lobbies shall be required on every floor and shall be enclosed by smoke partition walls having a minimum fire resistance rating of 1-hour.

FIRE PROTECTION SYSTEMS

AUTOMATIC SPRINKLER SYSTEM

The building shall be fully sprinkle red and supervised .A secondary water supply equal to the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for high-rise buildings . The secondary water supply shall have a duration of not less than 30 minutes .

PORTABLE EXTINGUISHERS

- Portable extinguishers shall be provided at each compartment / floor of the building

HOSE REELS

- 8.3 HOSE REELS One First Aid hose reel shall be provided for every 1000 sq.m. Floor area, located in the vicinity of an exit staircase.

FIRE PUMPS

- Fire pumps and jockey pumps shall be designed and installed per NFPA 20 based on the hydraulic demands of the fire protection systems provided.

WATER SUPPLY TANKS

- Terrace tank with a minimum capacity of 100,000 Liters shall be installed to provide an adequate water supply for fire protection systems.
- An underground water tank with a minimum capacity of 4.00 lakhs Liters shall be provided for firefighting purposes.

LIGHTING

CONTENT

ROLE OF LIGHTING-

- In a museum ,light must perform dual function
- Must serve for the interpretation of the both object and the surrounding space.
- The light is capable of sending large number of messages

- To guide
- Inform
- Separate / bring together
- Hide / Reveal
- Brighten / Sorrow.
- Enlarge / Reduce

WHY NATURAL LIGHT?

- Interior lighting has multiple functions to reveal the object to generate a pleasant welcoming ambience.
- Natural light contains all the visible colours in equal amounts.
- It is diffused as a soft white colour which enhances and accentuates shape , texture and colour.
- Daylight contributes to our mood and can make visitors and employees feel comfortable and at-ease.
- Being able to switch off electricity during the day and diffuse natural sunlight is both financially and environmentally responsible for museums.

HOW TO USE NATURAL LIGHT

- The delicacy and rarity of museum artefacts means that there are certain aspects to consider when integrating daylight intro museum :
- UV exposure should be limited
- Infrared should equally be avoided
- Day light should be concentrated and directed to specific areas, and should , if possible incorporate artificial light
- Light is one of the greatest cause of deterioration in museum collections, so the right type of light and right quantity of light is paramount
- Daylight is essential to our vision and therefore should be considered as a means of communication within museum.
- Diffusing daylight therefore has numerous positive impacts.

ARTIFICIAL LIGHTING

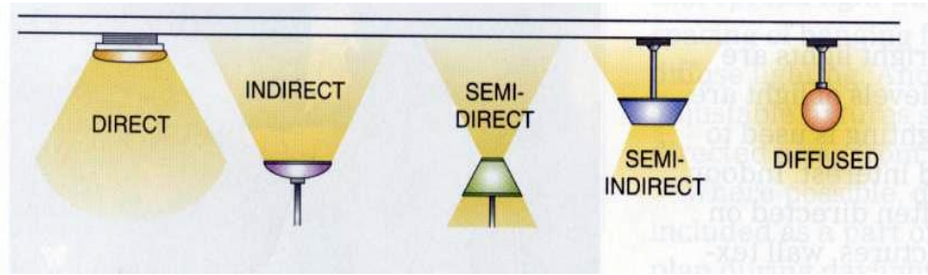
- Artificial light sources include incandescent, fluorescent, HID, fibre optics, cold cathode and LEDs.
- In museums, incandescent, fibre optic and HID are the most common light sources.
- The location and purpose of the light, along with the type of light source, become crucial in providing
- the correct amount of light and the lamp properties for interior applications in the museum.
- The intensity of light can be easily controlled.

OBJECTS CONSIDERED IN MUSEUM

- ✓ Sculpture
  - o Wood
  - o Stone
  - o Ivory
  - o Glass
  - o Marble
- ✓ Painting
  - o Oil
  - o Water Colors
- ✓ Textiles
- ✓ Brass Plates
- ✓ Weapons
- ✓ Machines
- ✓ Manuscripts
- ✓ Porcelain Dishes
- ✓ Jewelry
- ✓ Furniture

METHODS OF LIGHTING

DIRECT LIGHTING



- Widely used lighting system , in this system more than 90% of the total light fulx is amde to fall directly on the working plane with the help of deep reflectors.
- Its is mainly used in general outdoor and industrial lighting.
- Through out the most efficient but causes a hard shadow and glare appear during lighting.

SEMI DIRECT LIGHTING

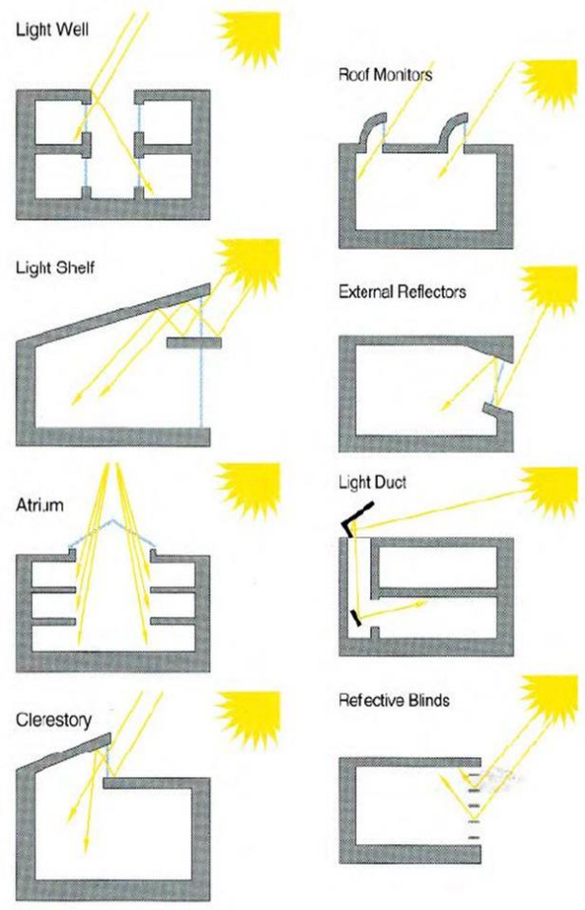
- In This lighting scheme 60 to 90% of the total light flux is made to fall downward directly with the help of semi direct reflectors.
- Reaming light is used to illuminate the ceiling and walls. such a lighting scheme is best suited to room with high ceiling where a high level of uniformly distributed illumination is desirable.
- The Glare in such units is avoiding by employing diffusing globe which not only improve thew brightness toward the eye level but also improve the efficiency of the system with reference to working plane.

SEMI INDIRECT LIGHTING

- In this lighting scheme 60 to 90% of total flux is thrown upwards to the ceiling for diffuse reflection and the rest reaches the working plane .
- Direct excepts for some absorption by the bowl .This lighting scheme is with soft shadows and glare free.
- It is mainly used for indoor light decoration purpose.

INDIRECT LIGHTING

- In this lighting scheme more than 90% of total light flux is thrown upwards to the ceiling for diffusion reflection by using inverted or browl reflectors.
- in such a system the ceiling acts as the light source, and the glare is reduced minimum.



ARTIFICIAL LIGHTING IN DISPLAY AREAS

Artificial lighting by definition is any light that does not come from sunlight. It is man made lighting, including fluorescent, tungsten, mercury vapour, sodium vapour, halogen, compact fluorescent, etc. In addition, all artificial light can be turned on and off with a switch.

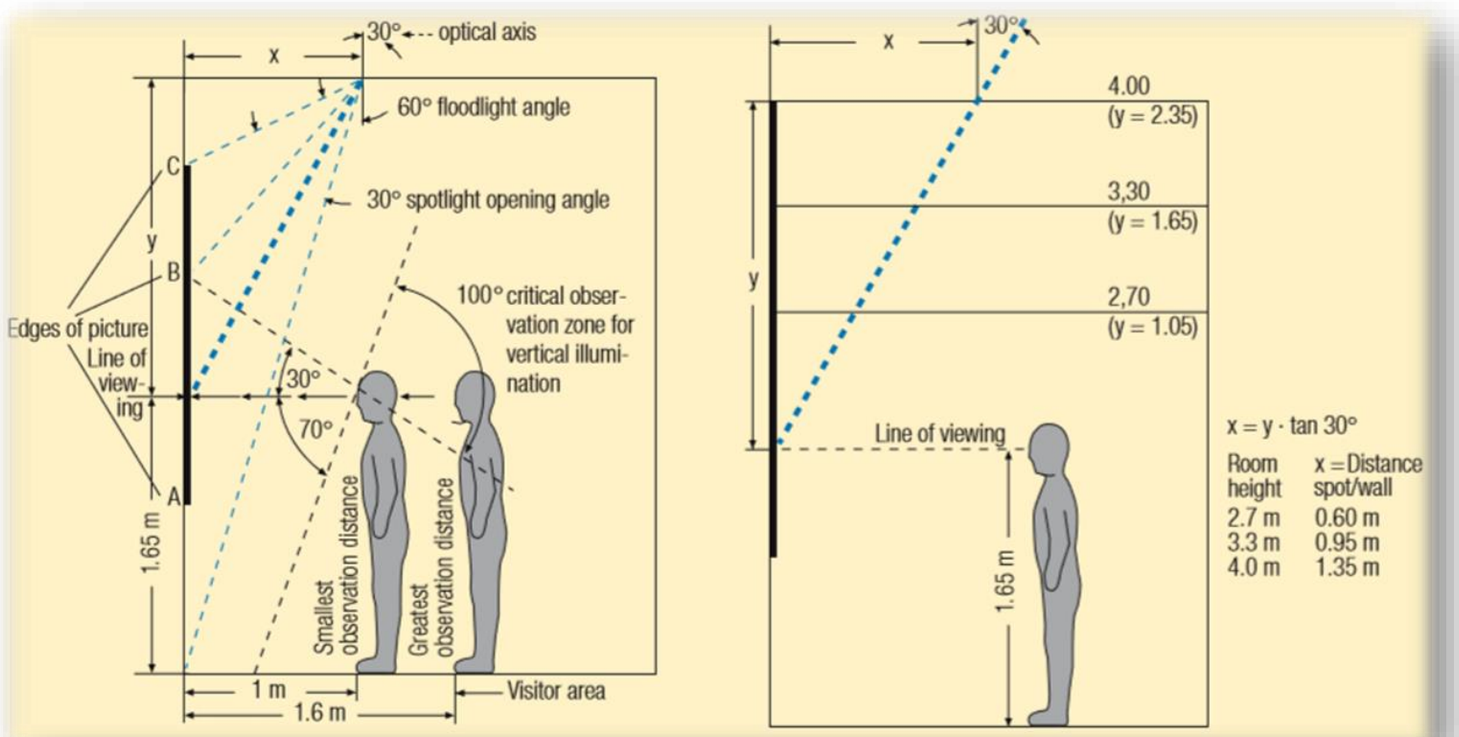
Types of artificial lighting

The most important lighting systems used in exhibition rooms are:

Luminous ceilings with opal glass enclosure (diffuse light) or sanitised and textured glass (diffuse/ directional)

- Luminous ceilings are particularly suitable for painting galleries. The cove lighting provides additional brightness.
- Tubular fluorescent lamps are generally used.
- Arranged according to the structural grid of the luminous ceiling.

- Luminous ceilings imitating natural daylight need to deliver a high level of luminance: 500 to 1,000 cd/m2, ranging up to 2,000 cd/m2 for very high-ceilinged rooms.
- They are suitable for interiors with ceiling height 6 meters or higher.



Cove luminaires (diffuse) :

o These are the diffuse light of luminaires installed in the curving transition between wall and ceiling.
o Used in modern museums.
oThe main direction of light with cove lighting is closer to the horizontal than with a luminous ceiling and corresponds roughly to that of perimeter luminaires mounted in continuous rows.
- o The lights are shadow free.
- o Fluorescent lamps – are the most widely used light source.

Indirect luminaires (diffuse) :

- o Its impact is similar to that of luminous ceiling.
- o The indirect light bounces off the ceiling and upper wall surfaces into the room.
- o Used in rooms where no daylight enters.
- o Produced by suspended luminaires radiating light upwards.

Wall washers (directional or diffuse/directional):

oThey are used either in individual luminaries or continuous rows.
o Wall washers distribute their light asymmetrically.
o This task is performed by reflectors with asymmetrical optics.
oFavoured light sources for wall washers include linear lamps: fluorescent lamps, compact fluorescent lamps in elongated designs, linear high-voltage halogen lamps.

Spot lamps :

- o The directional light of spot lamps raises the brightness for exhibits – here with an appropriate beam angle for paintings.
- o Elements on the luminaire for mounting accessories – such as filters or anti-glare flaps – are useful.

- ✓ Light levels can vary depending on the type of exhibition, the material being displayed and the desired ambience. The balance between conservation and display requirements must be carefully considered. Objects can be grouped into three categories of light sensitivity:

o Insensitive to light: metals, stone, ceramics, glass and enamels.

o Sensitive to light: oil paintings, wood, ivory, bone, some works on paper

o Textiles, art on paper, fur and feathers, dyed leather

- ✓ These are the recommended minimum light levels
- Good lighting is extremely important for visually impaired and older visitors so ensure that adequate lighting is provided on the vertical planes of graphic displays.

Task	Maintained Illuminance	Limiting Glare Rating	Min Colour Rendering
Ambient lighting	50–300 lux	28	80
Visitor circulation routes	100–300 lux	28	80
Insensitive to light displays	50 lux		No UV light
Sensitive to light displays	150 lux		
Very sensitive to light displays	No maximum		
Work surface (general)	300–400 lux		
Work surface (detailed work)	400–1000 lux		
Text panels	100–300 lux	25	80
Directional signage*	200–300 lux	19	80
Ramps, stairs	150–300 lux	25	80
Objects, specimens	Note 1		90T ≥ 4000K
Reading Areas	500 lux	19	80

- Use non reflective glass or film on all interactives, cases, displays and paintings wherever reasonable. When low light levels are called for, find the best compromise between conservation and disabled visitor requirements.
- Consider temporary or timed illumination of objects, e.g. by timed push button.

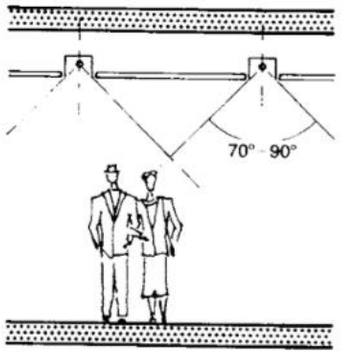
TAKING ACCOUNT OF LIGHTING

Where revolving exhibitions are staged in day lit rooms, daylight incidence and the position of showcases in relation to windows (see page 9) must also be taken into account. To maximize the scope for catering to exhibition requirements, it is best to ensure that day lit rooms can be fully darkened.

SKYLIGHTS

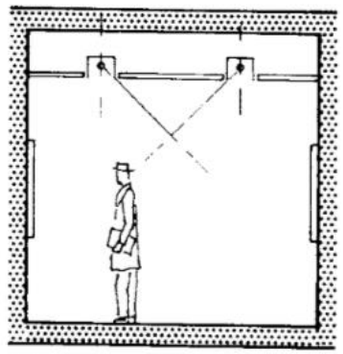
- Skylights are classic daylighting elements for picture galleries.
- They provide uniform, diffuse lighting. Because the light is admitted over a large area, the shadows produced are soft.
- The incident daylight that passes through a skylight reaches nearly every part of the room, including freestanding display cabinets, sculptures and partitions.

ARRANGEMENT OF ARTIFICIAL LIGHTING

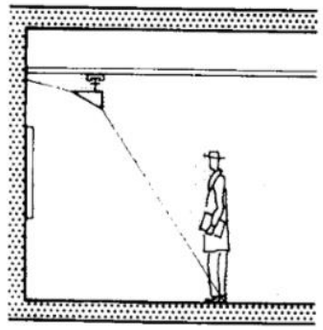


① Direct symmetrical illumination

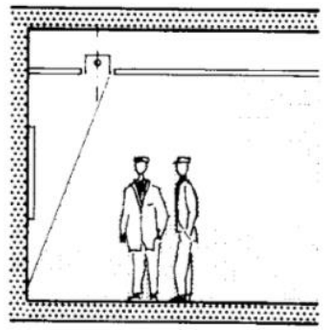
- Preferred in work rooms, meeting rooms, circulation ,etc


② Wall flood; direct illumination

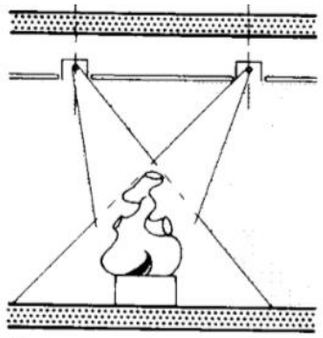
- Provides uniform wall illumination- direct light rest of the room


③ Wall flood on a power supply rail; partial room illumination

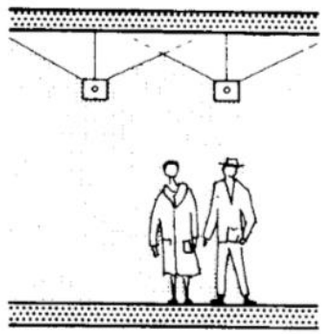
- Uniform wall illumination depends upon separation b/w lamp and wall.


④ Wall floodlight

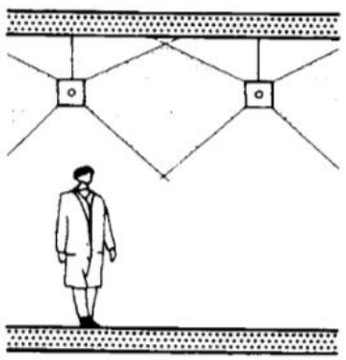
- Provides low room light or illumination of a single wall.


⑤ Directional spotlights

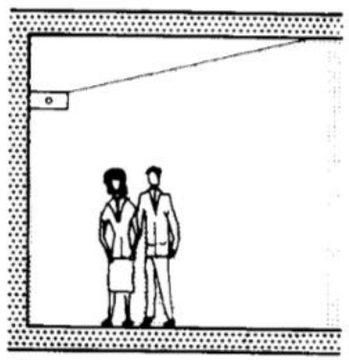
- By regular arrangement of lamps on celling


⑥ Indirect lighting

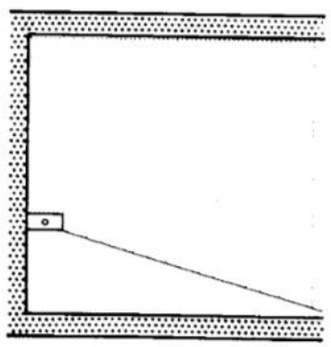
- Gives impression of bright room – free of glare – high ceiling

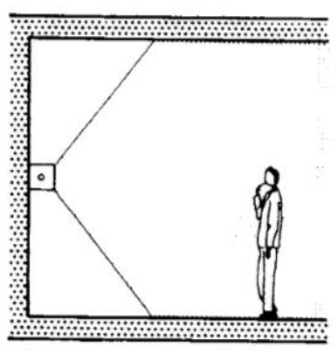

⑦ Direct/indirect lighting

- Fluorescent lamps are generally used

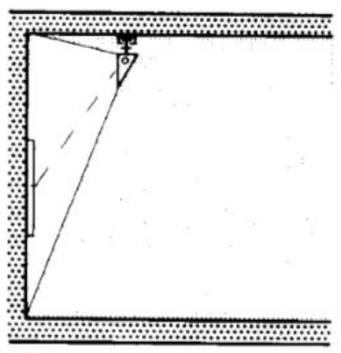

⑧ Ceiling floodlighting

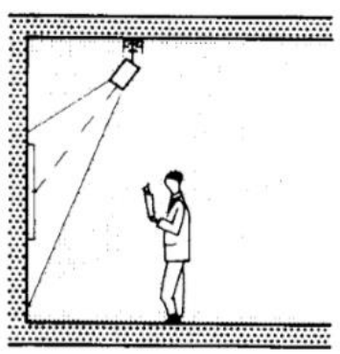
- Generally employed to illuminate ceiling or flooring.


⑨ Floor floodlighting

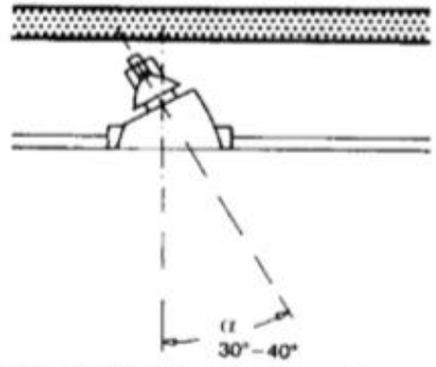

⑩ Wall light; direct/indirect lighting

- Decorative wall lightings.

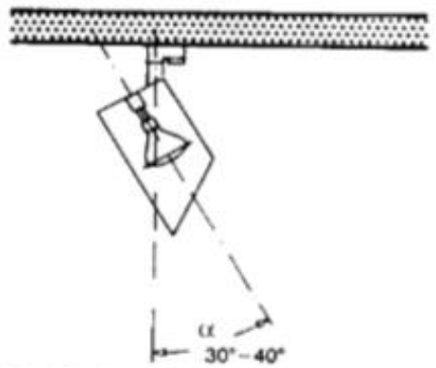

⑪ Wall flood on power supply rail


⑫ Spotlight on power supply rail

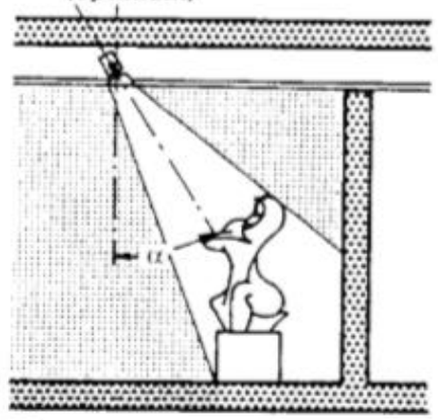
- Generally used in sale rooms, exhibitions , museums and galleries.



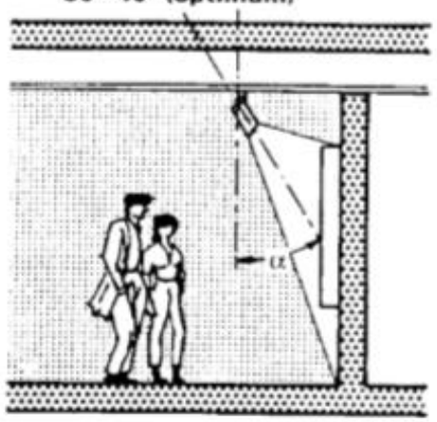
5 **Angle of inclination of directional spotlights and floodlights: α = 30°–40° (optimum)**



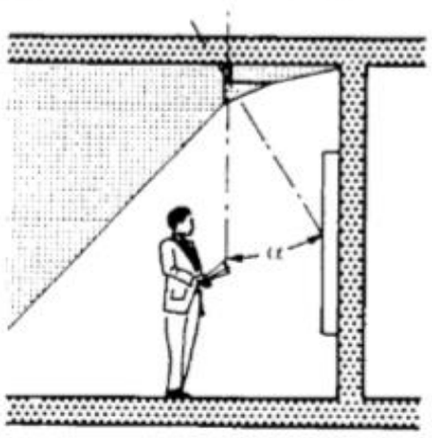
6 **Angle of inclination of spotlights illuminating objects and walls: α = 30°–40° (optimum)**



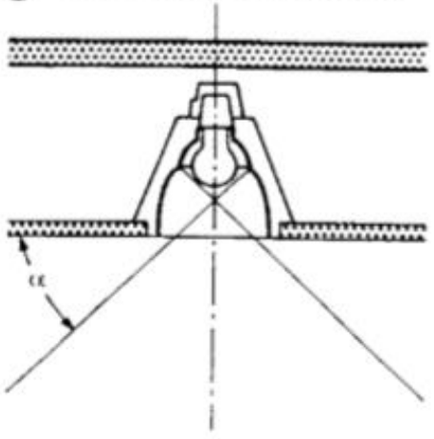
7 **Illumination of objects**



8 **Wall illumination, spotlight**



9 **Wall illumination, floodlight**



10 **Shading angle (= 30°/40°/50°)**

EXAMPLES :

9

Spot with 15° beam angle and ambient luminescence

10

Spot with 15° beam angle and diffuse ambient luminescence

11

Contour spot with no ambient luminescence

12

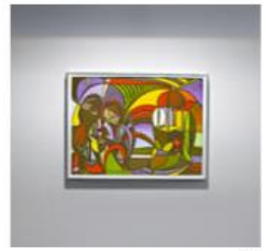
Diffuse ambient luminescence

13

Spot with 15° beam angle and soft focus lens

14

Spot with 45° beam angle and oval lens



15

Wallwasher with symmetrical light distribution fitted with R7s halogen lamps (230 V)

16

Wallwasher with asymmetrical light distribution fitted with R7s halogen lamps (230 V)

17

Spot with 15° beam angle, lighting from front, top, middle

18

Spot with 15° beam angle, lighting from front, top, left

19

Spot with 15° beam angle, lighting from front, bottom, left

20

Side lighting from right

21

Lighting from front

22

Lighting from back

23

Lighting from right

24

Lighting from above

LIGHTING FOR VARIOUS SPACES

FOYER , CORRIDOR, STAIRCASE

Foyers space also serve a functional purpose as they lead into the interior of the building.

- A harmonious lighting atmosphere sets the scene for a friendly reception.
- Ranges between 150 to 300 lux.
- Direct or direct/indirect luminaires with compact fluorescent lamps are the most widely used and wall luminaires for indirect lighting.
- During the day, the immediate entrance area needs to be particularly brightly lit.
- At night, illuminance inside the building should decrease towards the exit.
- For high ceilings ,high-intensity spots with high-pressure discharge lamps are re -commended.

Corridors, staircases and lifts connect the entrance area with the deeper recesses of the building.

- Mini of 100 lux is required.
- Entry desk – 300 to 500 lux
- Lifts : 50 – 50 lux

- The illuminance should be at least 150 lux should be given for the stairs and ramp.
- Wall lights at the side of the stairs casting direct light onto treads.

LIBRARY

Library lighting has several functions: it helps to get our bearings, find the literature we need , facilitates reading and creates a peaceful to subtly stimulating atmosphere.

- Circulating areas - 100 lux,
- Shelving systems - 200 lux.
- Reading areas - 500 lux.
- Counter – 300 lux

- Wall washers with asymmetrical beams are particularly suitable for this lighting task.

CAFETARIAS AND MUSEUM SHOPS

These are attractive places, especially at the end of a museum visit.

- ✓ Pendant luminaires for tables.
- ✓ Wall luminaires and downlights for a moderately higher lighting level.
- ✓ Downlight sand spots for accent lighting.
- ✓ Service areas in a cafeteria can keep a low profile.
- ✓ Where food and drink are displayed or on sale need to be more brightly lit than the rest of the room. Stimulates 200 – 300 lux.

- A distinction needs to be made between "viewing light" and "display light" – for shelves, walls or special offer presentations on the sales floor.

WORK PLACE LIGHTING

Which are not open to the public and where the lighting caters solely for the visual tasks performed by the people who work there.

- These rooms are essentially offices, e.g. administration areas, workshop and storage facilities such as warehouses, depots and archives.
- luminance in the task area must be no lower than 300 lux.

- Illuminance in museum workshops, including training workshops, should be 500 lux.
- Storage lighting -.mini of 100 lux is required. 300 lux vertical illuminance is used for handling small and delicate things.

OUTDOOR EXHIBITS

OPEN AIR MUSEUM

Open air museums are a showcase for historical buildings and complexes.

- For outer space recessed ground floods , lighting from below can be used.
- To avoid glare lights need to be set at a greater distance than for highlighting details.
- Directional signage :200-300lux

FACADE LIGHTING

- Light can make any building an eye-catcher.
- Ensuring floodlights are not installed too close to the building avoids excessively deep shadows.
- Illumination is also possible with wall luminaires integrated in the facade and recessed ground floods positioned directly in front of it.

- Floods with a long-range impact should be positioned high and mounted as inconspicuously as possible.
- If daylight and artificial light are mixed, their rays should be fully blended if not the exhibits will be distorted.

COVERD CAR PARKING

- Floors : 5-20 lux
- Ramps and corners: 30
- Entrances and exits: 50-150
- Control booths: 150-300
- Outdoor car parks: 5-20

MATERIALS TO BE ADOPTED

- All materials used for display purposes must be approved by the Conservation. Department, and must be tested by the recognized bodies.
- Materials and finishes used in construction must meet current fire regulations.
- Display objects against a 70% contrasting background wherever possible.
- Display objects against a plain background wherever possible.
- Background colors should contrast, but not overwhelm or jar, with the items inside the display case and provide 70% tonal contrast.

Objects can be grouped into three categories of light sensitivity:

- Insensitive to light: metals, stone, ceramics, glass and enamels.
- Sensitive to light: oil paintings, wood, ivory, bone, some works on paper.
- Textiles, art on paper, fur and feathers, dyed leather.

Reflective and Translucent Surfaces – Eliminating Glare

- Take care to eliminate unnecessary reflections and glare from light sources. Items to consider are video monitors, computer screens, glazed objects, highly polished objects, display cases, and so on.
- When assessing potential reflections and glare, consider the aspect for both standing and seated visitors. Where children are the target audience, take special care to eliminate glare at child height (between 800mm and 1060mm).

LIGHT AND PSCYCOLOGY

Lighting is a key factor in helping the space meet the intent of its owner and the needs of its users.

- ✓ Thinking of layers
- ✓ How light affects the users of a space on both psychological and behavioral level
- ✓ The play of colour and light

LAYERS IN LIGHTING PROCESS

- ***Visual task***: : providing enough light to walk safely through a corridor
- ***General lighting or Ambient lighting***: to set a mood or impression and maybe the lighting that provides for safe circulation within the space
- ***Visual interest***: something that adds a touch of magic, or something to tickle the user's "joy button."

How lighting shapes behavior and users response

- Visibility of vertical and horizontal junctions aid orientation
- People follow the brightest path
- Brightness can focus attention
- Facing wall luminance is a preference
- Lighting can affect body position
- uniform/non-uniform distribution of light
- bright/dim levels of illumination
- overhead/peripheral (or wall) lighting

Lighting could create a space that would make users say it was:

- "pleasant" versus "unpleasant"
- "public" versus "private"
- "spacious" versus "confined"
- "relaxed" versus "tense"
- "visually clear" versus "hazy"

FEW GENERAL GUIDELINES WE MAY CHOOSE TO FOLLOW

- **Public** :Requires the opposite with a uniform distribution of light, and more ceiling lights

- **Pleasant** :Utilizing more wall lighting as opposed to ceiling lights, as well as breaking up the lighting in the room.

- **Spacious** : Provide overall high levels of illumination with even distribution of light on walls and uniform lighting on all surfaces.

- **Relaxed**: Use non-uniform distribution, wall lighting and lower light levels, typically.

- **Visually Clear**: Provide higher luminance on the activity/task planes, with peripheral luminance

BASIC OBSERVATIONS IN HUMAN ACTIVITY TOWARDS LIGHT

- ❖ Lighting designers may choose to illuminate a certain space more than others to draw people towards it.
- ❖ When given a choice people will move towards light, acting like moths.
- ❑ Designers can also use this concept to **FOCUS** attention on a particular object by increasing the **contrast** between the illuminated surface and the surfaces surrounding it.
- ❑ An example of this in practice can be seen in many bars and nightclubs, where either the bar, or the wall behind it is illuminated to create a contrast with its surroundings and pull people towards it.

THE WORLD OF COLOURS

- The ***visual, emotional, psychic*** and ***biological*** effects that color and light on humans
- Natural light is essential for normal healthy life .
- The rhythms of light and dark is essential.
- If regulated exposure to light is not achieved, and either exposure to light or dark is prolonged, it may have strange effects on us.

Color can have temporary psychological and physiological effects on us

- Red- will raise blood pressure, pulse rate, respiration, perspiration and excite brain waves.
- Green - effects are more or less neutral
- Blue - lower blood pressure ,pulse rate and perspiration and brainwaves start to decline.
- Orange and yellow- similar to effects of red, but less pronounced.
- Purple and violet- similar to blue.

Bright

Dim

There is a very "public" approach to lighting, Compare that to the small specialty shop where the lighting subjective impression is more "private" and there is an expectation that there will be lower light levels, a sales person to assist, fewer customers, and often higher product costs. The same expectations are true for the lighting of fast food restaurants compared to more expensive restaurants.

EXAMPLE

- When it comes to navigating through a space we may struggle if there is not sufficient lighting where **vertical meets horizontal,** an Example for this could be a hallway in a hospital, where if the light falling on the wall and floor where the same in value in hue, it would become a visual problem, making it hard for us to navigate easily.
- Reference : Delores (Dee) A. Ginthner, Associate Professor University of Minnes

The museum mission aims at

1) Collect and exhibit art and historic artefacts for public education and enjoyment,

2) Protect the collection from damage, and

3)Do this all as efficiently as possible.

That's it, Pure and Simple… preserving and presenting our art and heritage.

Effects of lighting in museum

Chemical change due to excess light

Fading caused by light damage

- ✓ Exhibition always increases the risk of damage.
- ✓ The more visible and more accessible an artefact, the higher the risk
- ✓ For our purposes, exhibition increases the dangers of light damage,

both photochemical damage (fading) and photomechanical damage (structural damage).

Effects of UV radiation

A staircase inlaid with marquetry at Claydon House, Buckinghamshire, faded by sunlight and damaged by heels (National Trust Photographic Library / Rob Matheson)

Oil paints and varnishes

- ✓ Drying oils, such as linseed oil, are used as the medium for oil paints.
- ✓ When exposed to UV radiation in daylight, the long molecular chain become unstable and a variety of reactions take place .
- ✓ As a result the drying oils 'polymerise' to a semi-solid state.
- ✓ They are also **bleached by light and tend to increase in transparency over time.**

The amount of damage that light causes depend on :

1) The type of light,
2) The materials from which the objects are made
3) The time exposed to light.
4) Exposure to light in all forms causes a chemical reaction to happen within the molecular level of an artefact.
5) Decreasing the intensity of light will decrease the rate of photochemical damage but will not completely prevent damage.
6) The best preservation practice would be to house all artefacts in complete darkness but some amount of light is needed to see an object.

Wood

- ✓ Wood contains cellulose, Cellulose undergoes auto-oxidation in the presence of UV radiation leading to bleaching of the surface Cellulose.
- ✓ results weakening the material.
- ✓ Nevertheless, **deterioration** is unlikely to have a **significant effect on the structural integrity of joinery** because joinery is usually solid and auto-oxidation only occurs at the surface.

Pigments and dyes

- ✓ The materials and fittings which are most vulnerable to deterioration when exposed to visible as well as UV radiation include naturally dyed textiles, tapestries, and costumes, dyed leather, paintings in distemper media, gouache and watercolours, prints and drawings, and wallpapers .
- ✓ Damage **occurs on two fronts; loss of colour and pattern, and the structural deterioration of the fabric**

Textiles

- ✓ Textiles made from natural fibres also contain a high proportion of cellulose, which deteriorates in the same manner as the cellulose of wood.
- ✓ As textiles are far more fragile objects than joinery and the **fibres often become brittle, leading to rapid structural deterioration.**

Controlling

Categories of Objects Visible Light Sensitive collections

✓Including textiles, photographs, works on paper , watercolours on any medium, feathers, etc.

✓Maximum:50 lux

Less sensitive collections

✓Including oil paintings, wood, leather, acrylic paint surfaces, polychrome, panels, furniture,

✓Maximum: 150 lux

Least sensitive collections

✓Including most metal, ceramics, stones and glass

✓ Maximum:300 lux

Curtains at Blickling Hall, Norfolk made brittle by sunlight and damaged by touch (National Trust Photographic Library / Rob Matheson)

Controlling- Ultraviolet light

- ✓ UV should be completely eliminated.
- ✓ All of the techniques used to limit visible light will also cut down on UV light.
- ✓ To block the remaining UV light Install filtering material.
- ✓ Types of filters include:
    - UV filtering film for windows or glass on framed objects
    - UV filtering plex iglass instead of glass
    - Filter sleeves for fluorescent tubes
    - UV filtered fluorescent tubes)
- ✓ Monitor UV radiation at least every five years to be sure the filtering material is still effective.

Controlling Infrared radiation

- ✓ IR(heat) generated by natural or artificial lighting should also be controlled to prevent rapid changes in relative humidity.
- ✓ Window coverings and filters and good air circulation systems (for example, fans and air conditioners) help control heat build up.
- ✓ Control the heat produced by artificial lighting fixtures by using filters and good air circulation systems, as well as keeping lights outside exhibit cases

Precautions

- ✓ A reliable roof that covers all organic artifacts (and preferably most inorganic artifacts).
- ✓ Reliable walls, windows, and doors that block local weather, sunlight, local pests , amateur thieves, and vandals.
- ✓ Avoid areas of direct sunlight and intense spot lamps at close distances on all organic artifacts
- ✓ Minimize exposure to light, especially UV.
- ✓ Keep levels as low as possible.
- ✓ Use storage rooms that are windowless.
- ✓ Rotate the artifacts for 'resting period' in the storage.
- ✓ To help limit the duration of exposure of materials, timed light switches can be used in storage rooms

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SERVICES

MUSEUM DESIGN

ABSTRACT

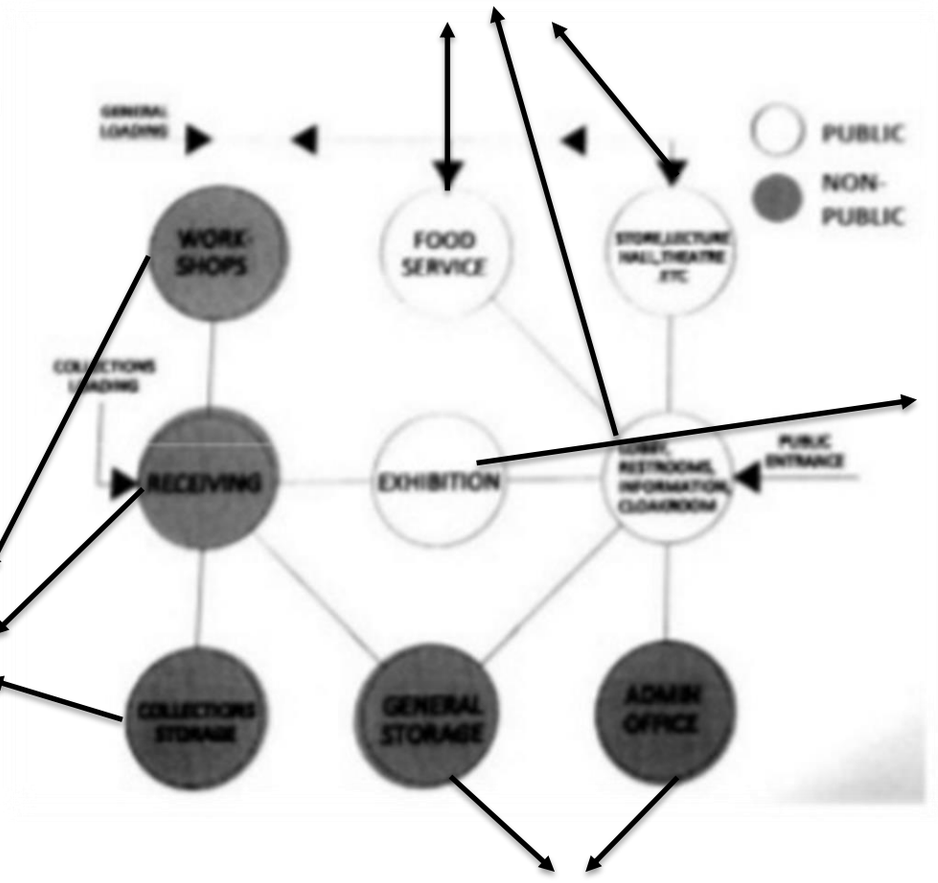
The services and maintenance of any building is essential, and more so for a museum. A museum houses different kinds of artefacts and objects, from different parts of the world and periods in history. Preservation of these artefacts should be the highest priority. Hence the services and maintenance related features will be covered in the following slides

CONTENTS

BUILDING MANAGEMENT/AUTOMATION SYSTEM

- A building management/automation system may be considered to be provided for controlling and monitoring of all parameters of HVAC, electrical, plumbing, fire fighting, low voltage system such as telephone, TV, etc
- In a museum planning, building services engineering comprises mechanical engineering, electrical engineering and plumbing engineering (MEP) that can be further divided into
  - ✓ Communication lines,
  - ✓ Telephones and it networks
  - ✓ Escalators and lifts
  - ✓ Fire detection and protection
  - ✓ Heating and ventilation and air conditioning (HVAC)
  - ✓ Lightning protection natural lighting and artificial lighting,
  - ✓ Building surfaces
  - ✓ Security and alarm systems
  - ✓ Water, drainage and plumbing

ZONE A-public non collection areas- foyer, lobby, shop, cafe, public washrooms etc

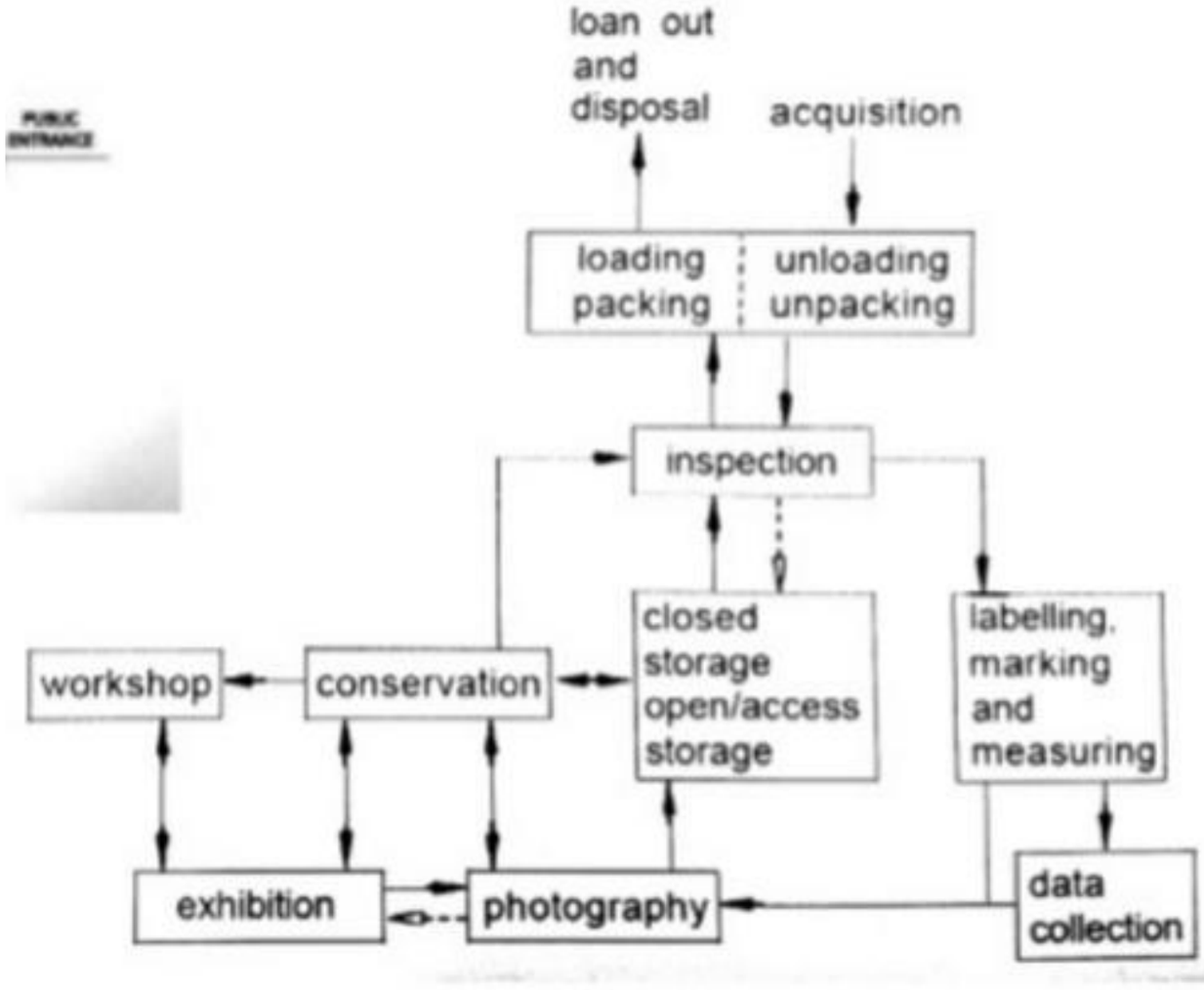


ZONE B-public collection areas-permanent and temporary collection display, open for public

ZONE C-non public collection areas- collection storage rooms, packing-unpacking spaces, crate storage rooms, conservation labs, elevators used for transporting collections

(REF:-Manual of Museum Planning: Sustainable Space, Facilities, and Operations)

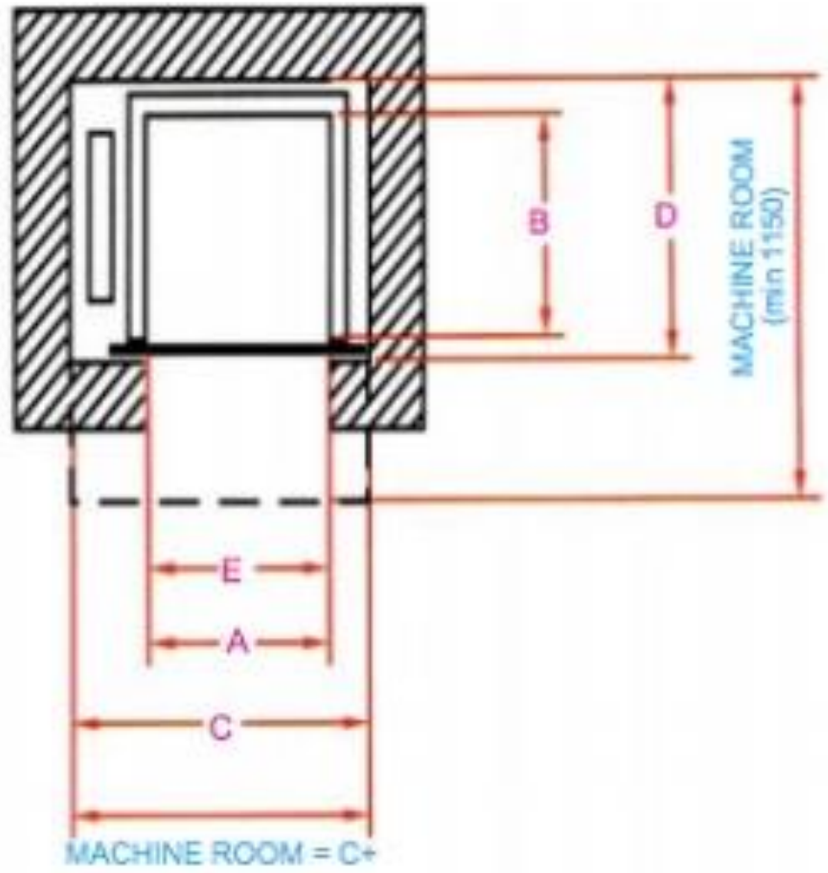
ZONE D-nonpublic non collection areas- offices, non collection storage areas, workrooms, security stations, staff washrooms etc.



STORAGE AREAS

SHAFT DETAILS:
electrical rising main shaft:2.2mX0.8m
wet riser shaft: 1.2mX0.8m
telephone shaft:0.6mX0.3m
fire alarm shaft:0.6mX0.6m

Fire control room-4mX3m near entrance lobby
Telephonic room-4mX3m



PLAN

LOAD	CAR INSIDE			LIFT WELL		ENTRANCE
Kg.	A	B	H	C	D	E
700	700	700	800	1200	900	700
800	800	800	900	1300	1000	800
900	900	900	1000	1400	1100	900
1000	1000	1000	1000	1500	1200	1000

All Dimensions in millimetres

SERVICE LIFT

PLUMBING AND WATER SUPPLY

In a building, provision is required to be made for storage of water for the following reasons:

- To provide against interruptions of the supply caused by repairs to mains, etc.
- To reduce the maximum rate of demand on the mains
- To tide over periods of intermittent supply
- To maintain a storage for the fire fighting requirement of the building
- The water may be stored either in overhead tanks (OHT) and/or underground tanks (UGT).

Materials Used –

- Reservoirs and tanks for the reception and storage of water shall be constructed of reinforced concrete brick masonry, ferro cement precast, mild steel, stainless steel or plastic.
- Every storage tank shall be easily accessible and placed in such a position as to enable thorough inspection and cleaning to be carried out. If the storage capacity required is more than 5 000 l, it is advantageous to arrange it in a series of tanks so interconnected that each tank can be isolated for cleaning and inspection without interfering with the supply of water. In large storage tanks, the outlet shall be at the end opposite the inlet to avoid stagnation of the water.
- The outlet pipe shall be fixed 50 mm to 75 mm above the bottom of the tank and fitted with a strainer, preferably of brass.
- Preferable to have underground pump house beside underground water reservoir to ensure flooded suction.
- Provide 1.5m wide ramp with suitable slope for easy access
- Roof slab may be 500m above G.L with ventilators, provided with water proofing
- The fire pump house size shall be 5.5mX8mX3.5m where engine driven fire pump, electric motor driven fire pump and pressurization pump are installed.
- One wet riser is required for every 1000 sqm of covered area

Table 1 Dimensions of Cylinderical Vertical Tank

(*Clause* 5.1)

Sl No.	Minimum Net Capacity Up to Effective Height (l)	Overall Dimeter Range (mm)	Overall Height Range (mm)	Minimum Internal Dia of Man-Hole/ Hand-Hole (mm)	Minimum Wall and Bottom Thickness (mm)	Minimum Weight of tank (Without Lid) (kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	200	650 - 850	490 - 690	265	3.0	7.8
ii)	300	650 - 850	700 900	265	3.0	9.0
iii)	400	700 - 980	700 - 950	265	3.5	15.0
iv)	500	800 - 1 140	625 - 1 025	370	4.0	18.0
v)	700	900 - 1 140	800 - 1 100	370	4.4	23.0
vi)	1 000	1 000 - 1 200	1 050 - 1 350	370	4.5	33.0
vii)	1 500	1 080 - 1 450	1 150 - 1 590	370	4.5	47.0
viii)	1 700	1 300 - 1 500	1 260 - 1 650	370	4.5	54.0
ix)	2 000	1 365 - 1 500	1 400 - 1 700	450	5.4	64.0
x)	2 500	1 380 - 1 610	1 400 - 1 810	450	7.7	81.0
xi)	3 000	1 410 - 1 800	1 640 - 2 150	450	8.1	96.0
xii)	4 000	1 450 - 1 920	1 750 - 2 400	450	10.4	147.0
xiii)	5 000	1 800 - 2 110	1 800 - 2 100	450	10.7	180.0
xiv)	6 000	1 800 - 2 200	2 065 - 2 800	450	10.7	205.0
xv)	7 500	1 890 - 2 250	2 100 - 2 930	450	10.7	239.0
xvi)	10 000	1 900 - 2 680	2 400 - 3 740	450	11.5	319.0
xvii)	15 000	2 100 - 2 680	3 100 - 4 000	450	11.5	408.0
xviii)	20 000	2 100 - 3 150	3 190 - 5 000	450	13.2	566.0

Table 2 Dimensions of Rectangular Loft Tanks

(*Clause* 5.2)

Sl No.	Minimum Net Capacity	Overall Length	Overall Width	Overall Height	Minimum Internal Dia of Hand Hole	Minimum Wall Thickness (Measured on) Rectangular Vertical Port and Bottom Thickness	Minimum Weight Weight of Tank (Without Lid)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	150	620 - 820	620 - 820	285 - 485	300	2.75	6.6
ii)	200	930 - 1 130	620 - 820	285 - 485	300	2.75	7.7
iii)	300	995 - 1 200	620 - 820	285 - 485	300	2.75	11.0
iv)	400	1 150 - 1 350	855 - 1150	335 - 535	300	2.75	13.0
v)	500	1 150 - 1 500	900 - 1250	335 - 535	300	2.75	17.5

NOTE — The gross capacity of the tanks shall be at least 5 percent in excess of the minimun net capacity.

(tables is l 2701 - 1996, cpwd campanion volume for general specifications of electrical works)

Sanitation Requirements for Assembly Occupancy Buildings (Art, Galleries, Libraries and Museums)

Sl. No.	Sanitary Unit	For Public		For Staff	
		Male	Female	Male	Female
1	Water Closet (W.C.)	One for 200 persons upto 400 persons. For over 200 persons, add at the rate of 1 per 250 persons or part thereof	One per 100 persons upto 200 persons. For over 200 persons, add at the rate of 1 per 150 persons or part thereof	One for 1-15 persons. Two for 16-35 persons	One for 1-12 persons. Two for 13-25 persons
2	Ablution Taps	One in each W.C.	One in each W.C.	One in each W.C	One in each W.C
3	Urinals	One for 50 persons or part thereof	--	Nil upto 6 persons One for 7-20 persons Two for 21-45 persons	--
4	Wash Basins	One for every 200 persons or part thereof. For over 400 persons, add at the rate of 1 per 250 persons or part thereof.	One for every 200 persons or part thereof. For over 200 persons, add at the rate of 1 per 150 persons or part thereof	One for 1-15 persons Two for 16-35	One for 1-12 persons Two for 13-25 persons
5	Cleaner's Sink	One per floor, minimum			
6	Drinking Water Fountain	One per 100 persons or part thereof			

All vertical soil, waste, ventilating and anti- siphonage pipes shall be covered on top with a copper or heavily galvanised iron wire dome or cast iron terminal guards. All cast iron pipes, which are to be painted periodically, shall be fixed to give a minimum clearance of 50 mm clear from the finished surface of the wall by means of a suitable clamps.

Drainage pipes shall be carried to a height above the buildings as specified for ventilating pipe of 3 m.

Soil pipes A soil pipe, conveying to
a drain, any solid or liquid filth, shall be circular and shall have a Minimum diameter of 100 mm.

The ventilating pipe shall always be taken to a point 1500 mm above the level of the eaves or flat roof or terrace parapet whichever is higher or the top of any window within a horizontal distance

SPACING OF MANHOLES

The spacing of manholes for a given pipe size should be as follows:

Pipe Diameter	Spacing of Manhole (mm)
Upto300	45
301 to 500	75
501 to 900	90
Beyond 900	Spacing shall depend upon local condition and shall be gotten approved by the Authority

RAIN WATER DRAINAGE

- The roofs of a building shall be so constructed or framed as to permit effectual drainage of the rain-water there from by means of a sufficient number of rain-water pipes of adequate size so arranged, jointed and fixed as to ensure that the rain water is carried away from the building without causing dampness in any part of the walls or foundations of the building or those of an adjacent building.
- Roof area (in square meters (horizontal plane)) X total annual rainfall (in mm) X efficiency factor / runoff coefficient = annual water supply in liters
- Gutter is provided along the edge of the roof. It is fixed with a gentle slope towards downpipe. which is meant for free flow of water to the storage tank . This may be made up of G.I. sheet, wood. bamboo or any other locally available material. The downpipe used should be at least 100mrn diameter and be provided with a 20 mesh wire screen at the inlet to prevent dry leaves and other debris from entering it.

ELECTRICAL SERVICES

- The design and planning of an electrical wiring installation involve consideration of all prevailing conditions, and is usually influenced by the type and requirement of the consumer. the clear height required for sub station equipments shall be a minimum of 3.6m.

Area for sub station

Sl No.	*Capacity of Transformer(s)* kVA	*Total Transformer Room Area, Minimum,* m^2	*Total Substation Area (In Coming, HV, MV Panels, Transformer Roof but Without Generators), Minimum*	*Suggested Minimum Face Width* m
(1)	(2)	(3)	(4)	(5)
i)	1 × 160	14.0	90	9.0
ii)	2 × 160	28.0	118	13.5
iii)	1 × 250	15.0	91	9.0
iv)	2 × 250	30.0	121	13.5
v)	1 × 400	16.5	93	9.0
vi)	2 × 400	33.0	125	13.5
vii)	3 × 400	49.5	167	18.0
viii)	2 × 500	36.0	130	14.5
ix)	3 × 500	54.0	172	19.0
x)	2 × 630	36.0	132	14.5
xi)	3 × 630	54.0	176	19.0
xii)	2 × 800	39.0	135	14.5
xiii)	3 × 800	58.0	181	14.0
xiv)	2 × 1 000	39.0	149	14.5
xv)	3 × 1 000	58.0	197	19.0

TABLE 1

Sub-Station with transformer capacity of	*Total transformer room area required*	*Total sub-station area required i/c HVMV panel transformers but without generators*	*Suggested minimum face width*
2*500 kVA	36.00 sqm	130.00 sqm	14.5 m
3*500 kVA	54.00 sqm	172.00 sqm	19.0 m
2*800 kVA	39.00 sqm	135.00 sqm	14.5 m
3*800 kVA	58.00 sqm	181.00 sqm	19.0 m
2*1000 kVA	39.00 sqm	149.00 sqm	14.5 m
3*1000 kVA	58.00 sqm	197.00 sqm	19.0 m

Area for generator

TABLE 2

Capacity	*Area*
25 kW	56.00 sqm
48 kW	56.00 sqm
100 kW	65.00 sqm
150 kW	72.00 sqm
248 kW	100.00 sqm

Sl No.	*Capacity* kW	*Area* m^2	*Clear Height below the Soffit of the Beam* m
(1)	(2)	(3)	(4)
i)	25	56	3.6
ii)	48	56	3.6
iii)	100	65	3.6
iv)	150	72	4.6
v)	248	100	4.6
vi)	350	100	4.6
vii)	480	100	4.6
viii)	600	110	4.6
ix)	800	120	4.6
x)	1 000	120	4.6
xi)	1 250	120	4.6
xii)	1 600	150	4.6

- In order to prevent storm water entering the transformer and switch rooms through the soak pits, the floor level of the substation shall be at least 15 cm above the highest flood water level that may be anticipated in the locality.
- Also, facility shall be provided for automatic removal of water. enclose any part of the substation, which is open to the air and contains live equipment which is not encased, with a fence or wall not less than 2.4 m in height to prevent danger or unauthorized access metal doors to be used

TEMPERATURE REGULATION

Temperature affects museum collections in a variety of ways.

- At higher temperatures, chemical reactions increase. For example, high temperature leads to the increased deterioration of cellulose nitrate NPS Museum Handbook, Part I (1999) 4:9film. If this deterioration is not detected, it can lead to a fire. As a rule of thumb, most chemical reactions double in rate with each increase of 10°C (18°F).
- Biological activity also increases at warmer temperatures. Insects will eat more and breed faster, and mold will grow faster within certain temperature ranges.
- At high temperatures materials can soften. Wax may sag or collect dust more easily on soft surfaces, adhesives can fail, lacquers and magnetic tape may become sticky. In exhibit, storage and research spaces, where comfort of people is a factor, the recommended temperature level is 18-20° C (64-68° F).
- Temperature should not exceed 24° C (75° F). Try to keep temperatures as level as possible. In areas where comfort of people is not a concern, temperature can be kept at much lower levels—but above freezing. Avoid abrupt changes in temperature. It is often quick variations that cause more problems than the specific level.
- Fluctuating temperatures can cause materials to expand and contract rapidly, setting up destructive stresses in the object. If objects are stored outside, repeated freezing and thawing can cause damage. Temperature is also a primary factor in determining relative humidity levels. When temperature varies, RH will vary. This is discussed in more detail in the next section.
- Relative humidity is a relationship between the volume of air and the amount of water vapor it holds at a given temperature. Relative humidity is important because water plays a role in various chemical and physical forms of deterioration.
- There are many sources for excess water in a museum: exterior humidity levels, rain, nearby bodies of water, wet ground, broken gutters, leaking pipes, moisture in walls, human respiration and perspiration, wet mopping, flooding, and cycles of condensation and evaporation. Relative Humidity Optimum Ranges for Various Materials Housed in a Park's Museum Collection

- ARCHEOLOGICAL MATERIALS
  - NEGLIGIBLE CLIMATE-SENSITIVE MATERIALS 30%–65%
  - CLIMATE SENSITIVE MATERIALS 30%-55%
  - SIGNIFICANTLY CLIMATE SENSITIVE MATERIALS 30%-40%
  - METALS.....<35%

- NATURAL HISTORY MATERIALS BIOLOGICAL
  - SPECIMENS.....40%-60%
  - BONE AND TEETH.....45%-60%
  - PALEONTOLOGICAL SPECIMENS 45%-55%
  - PYRITE SPECIMENS.....<30%
  - PAINTINGS.....40%-65%
  - PAPER ..... 45% - 55%
  - PHOTOGRAPHS/FILM/NEGATIVES..... 30%-40%
  - OTHER ORGANICS (WOOD, LEATHER, TEXTILES, IVORY).....45%-60%
  - METALS.....40%-60%

AIR CONDITIONING

The objective of installing ventilation and air conditioning facilities in buildings are to provide comfort to work efficiently.

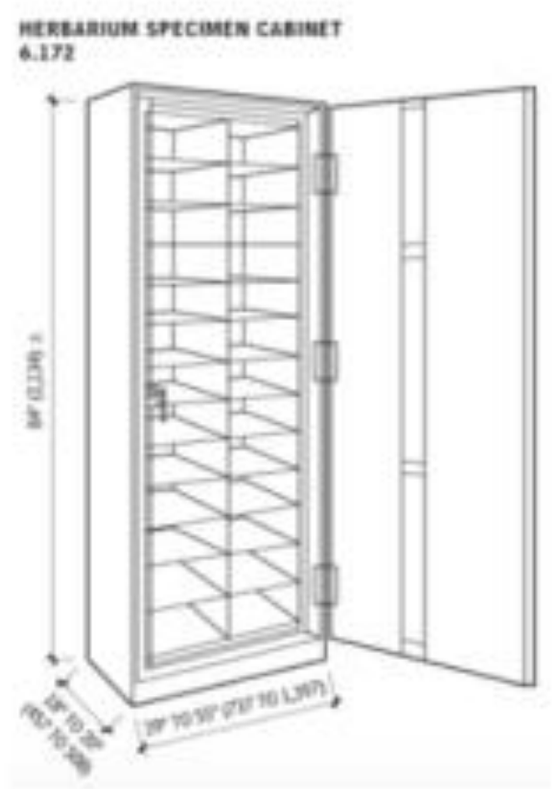
The aim of ventilation and air conditioning it to control and optimize the following factors in the building:

- Air purity and filtration
- Air movement
- Relative humidity
- Noise and vibration
- Energy efficiency
- Fire safety

- Equipment Room for Central Air Conditioning Plant :-In the case of large installations (500 TR and above), it is advisable to have a separate isolated equipment room where possible. The clear headroom below soffit of beam should be minimum 4.5 m for centrifugal plants, and minimum 3.6 m for reciprocating and screw type plants.
- Cooling Tower :-Cooling towers are used to dissipate heat from water cooled refrigeration, air conditioning and industrial process systems. Cooling is achieved by evaporating a small proportion of recirculating water into outdoor air stream. Cooling towers are installed at a place where free flow of atmospheric air is available.
- The recommended floor area requirement for various types of cooling tower is as given below:
    a. Natural draft cooling tower- 0.15 to 0.20 m2/t of refrigeration .
    b. Induced draft cooling tower- 0.10 to 0.13 m2/t of refrigeration
    c. Fibre-reinforced plastic 0.07 to 0.08 m2/t of refrigeration

STORAGE

- Museum storage space must provide adequate space to accommodate growth of the collection over the next ten years.
- Incorporate aisles at least 1.5m wide between rows of equipment; this width allows safe handling and movement of drawers, cabinet doors, and larger objects.
- Ceiling height is sufficient to accommodate raised and stacked cabinets without interfering with lighting and protection systems
- Different types of structures have different construction requirements. Therefore, installation of equipment such as fire and security systems, and storage furniture needs will also vary.
- Locate the storage space outside the 100-year floodplain.
- Use space that is constructed of fire-resistant or fireproof materials. Cover interior wood framed walls and ceilings with gypsum wallboard or other material to achieve a minimum one-hour fire.
- Install an adequate vapor barrier in walls, ceilings, and floors in a purpose built museum structure.
- Make sure the level of the top of the concrete slab is at least 6" above the grade level of the soil.
- Lighting is required in storage spaces.
- Eliminate ambient light sources that can damage objects that can damage collections.
- Use LED or UV-filtered fluorescent lighting. Remove or replace incandescent lighting to reduce energy costs over time.
- Provide indirect (diffuse) lighting by aiming fixtures at walls or ceilings.



PRESERVATION

- The role of preventive care, also known as preventive conservation, is to avoid, block, or minimise the agents of deterioration. By using preventive care techniques, the imperceptible deterioration that occurs on a daily basis (cumulative over time) and the occasional catastrophic damage can be limited. The agents of deterioration are as follows:
- Fire:- Fire resistance is essential for the protection of the artefacts. The materials that are used for construction must have good heat resistance.
- Water:- Water that causes efflorescence in porous materials, stains, swells organic materials, corrodes metals, delaminates and/or buckles layered components, and loosens joined components. Water and damp proofing is also important
- Pests:- Pests, such as insects that consume, perforate, cut, graze, tunnel and/or excrete and destroy, weaken, disfigure, or etch organic materials. Pests include vermin such as birds and other animals that gnaw organic materials and displace small objects, foul objects with feces and urine, and mold and microbes that weaken or stain objects. Architectural considerations must be made to resist pests, insects, and birds
- Contaminants:- Contaminants that disintegrate, discolor, or corrode all types of objects, especially reactive and porous materials. This includes gases (such as pollution, ozone, formaldehyde, nitric acid, sulfur dioxide), liquids (such as plasticizers, grease), and solids (such as dust, soot, salt).
- Light Levels:- Light levels including both ultraviolet radiation and visible light. Ultraviolet radiation disintegrates, fades, darkens, and/or yellows the outer layer of organic materials and some coloured inorganic materials. Visible light fades or darkens the outer layer of paints and wood. Incorrect temperature that can be too high causing gradual disintegration, discolouration or embrittlement of organic materials; too low causing embrittlement, which results in fractures of paints and other polymers; or fluctuating causing fractures and delimitation in brittle, solid materials.
- Incorrect Temperature :- Fluctuations in temperature also cause fluctuations in relative humidity. Incorrect relative humidity that can be damp, causing mold and corrosion, or above or below a critical value, hydrating or dehydrating some minerals and corroding metals that contain salts or cause embrittlement of other materials.
- Incorrect Relative Humidity:- Organic materials will gradually disintegrate, become brittle or discolour, especially materials that are chemically unstable at any RH level. Fluctuating RH will shrink and swell unconstrained organic materials, crush or fracture constrained organic materials, cause layered organic materials to delaminate and/or buckle, and loosen joints in organic components. NPS Museum Handbook,Part I (2012) Preservation: Getting Started

CLEANING AND MAINTENANCE

Cleaning and maintenance of museums is really important for the preservation of Artefacts.

- Dust is the one of the most common forms of pollution. There are several problems that can be encountered by dust, since it can build up quickly.
- It absorbs moisture so can create a humid environment in a small, confined area. Can be gritty and therefore abrasive when rubbed from an object. It attracts and harbours pests. Can absorb, carry pollutants and cause staining. It can collect in pockets and cause physical damage to objects through distorting their shape and causing cracks
- Pest control is also very important for the preservation.
- Provisions need to be made for vacuum cleaners, in terms of electrical points as well as storage.
- Creating an environment which can resist entry of dust is important, especially in areas used to store historic, delicate artefacts.
- Regulated are movement into the sensitive areas of the museum would help avoid dust getting into the space.
- Air Conditioning Ducts need to be well maintained. Air purifiers help in maintaining indoor air quality and also regulate dust.
- Carpets to be avoided, as they usually hold onto a lot of dust. Wet or damp mopping of floors helps get rid of dust, hence proper drainage of water in all spaces must be addressed.

SUSTAINABILITY

MUSEUM DESIGN

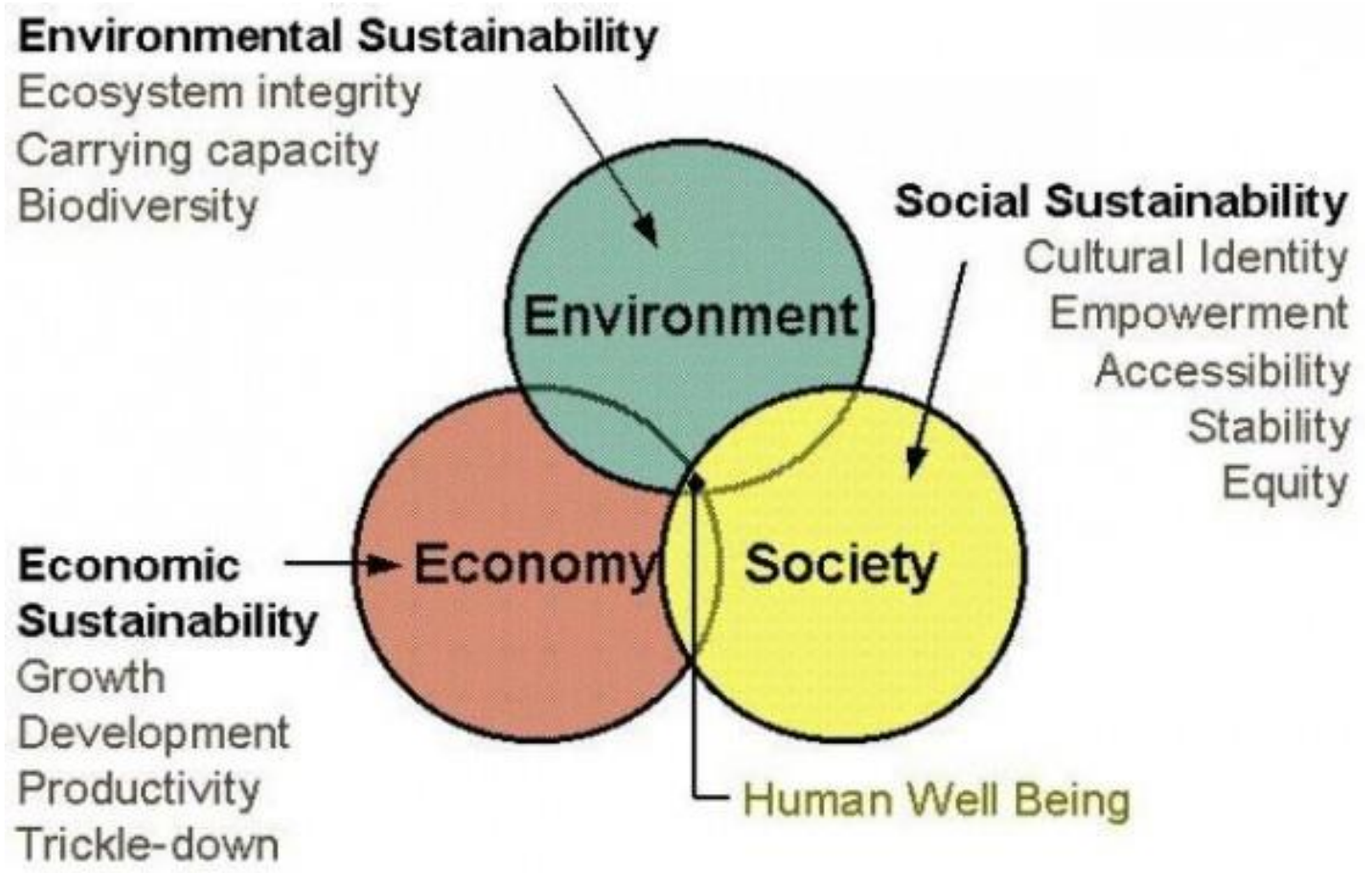
CONTENTS

INTRODUCTION

- **Sustainable architecture** is **architecture** that seeks to minimize the negative environmental impact of buildings by efficiency and moderation in the use of materials, energy, and development space and the ecosystem at large. This process covers environmental sources, starting from the design, implementation, construction, materials, maintenance, renovation, until the deconstruction of the building.
- Sustainable buildings should metaphorically **'tread lightly on the Earth'** by minimising the environmental impacts associated with their construction, their life in use and at the end of their life.
- Culture forms and holds humanity's deepest values, attitudes, and actions. Sustainability asks people to adapt at a cultural level, changing their beliefs and behaviour.
- Museums have a unique role to establish and promote a culture of sustainability. "In their role as places of authority and keepers of culture, museums have unequalled power and responsibility to model and to teach the methods of preserving ourselves, our planet and our cultural resources".

AIMS OF SUSTAINABLE DESIGN:

- Reduce the amount of energy consumed (during construction and use)
- Enhance material recyclability and component reuse
- maximize sustainable use of renewable materials
- Extend product durability where appropriate
- Building interior spaces should be responsive to outdoor environment.



Principles of Sustainability:

1. Observe & interact

"Beauty is in the eye of the beholder"

2. Catch & store energy

"Make hay while the sun shines"

3. Obtain a yield

"You can't work on an empty stomach"

4. Apply self regulation & accept feedback

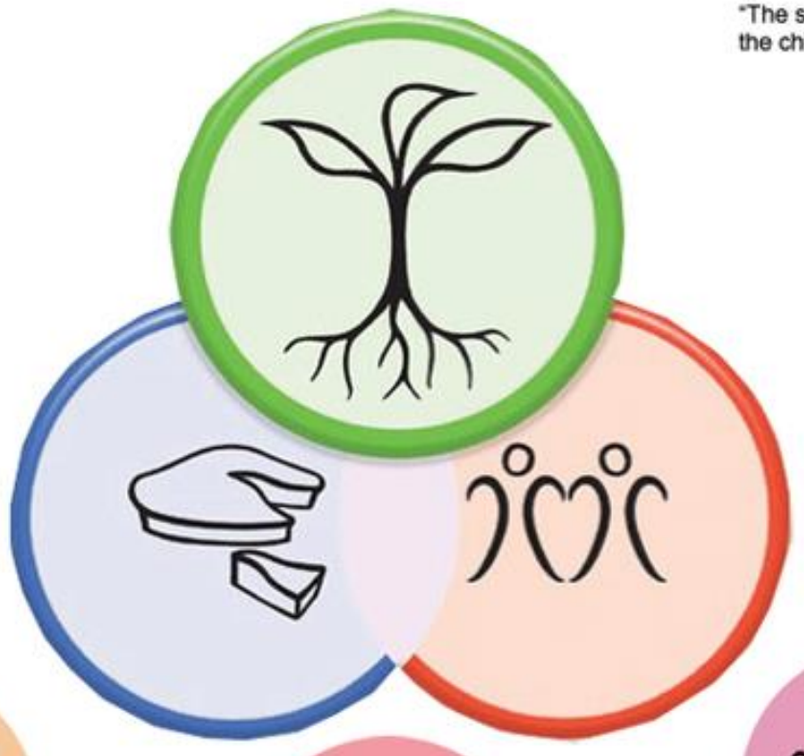
"The sins of the fathers are visited on the children of the seventh generation

5. Use & valve renewable resources & services

"Let nature take its course"

12. Creatively use & respond to change

"Vision is not seeing things as they are but as they will be"



6. Produce no waste

"A stitch in time saves nine"
"Waste not, Want not"

11. Use edges & valve the marginal

"Don't think you are on the right track just because it's a well-beaten path"

10. Use & valve diversity

"Don't put all your eggs in one basket"

9. Use small & slow solutions

"The bigger they are, the harder they fall"
"Slow and steady wins the race"

8. Integrate rather than segregate

"Many hands make light work"

7. Design from patterns to details

"Can't see the forest for the trees"

PRINCIPLES OF SUSTAINABILITY

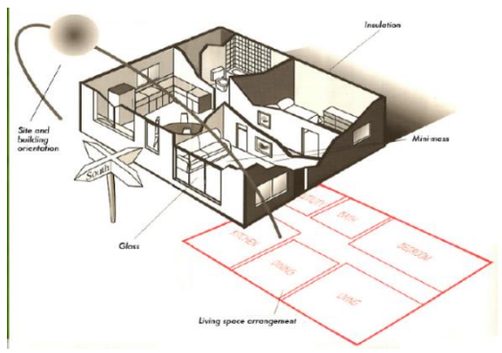
- **Observe and interact:** By taking time to engage with nature we can design solutions that suit our particular situation.
- **Catch and store energy:** By developing systems that collect resources at peak abundance, we can use them in times of need.
- **Obtain a yield:** Ensure that you are getting truly useful rewards as part of the work that you are doing.
- **Apply self-regulation and accept feedback:** We need to discourage inappropriate activity to ensure that systems can continue to function well.
- **Use and value renewable resources and services:** Make the best use of nature's abundance to reduce our consumptive behavior and dependence on non-renewable resources.
- **Produce no waste:** By valuing and making use of all the resources that are available to us, nothing goes to waste.
- **Use and value diversity:** Diversity reduces vulnerability to a variety of threats and takes advantage of the unique nature of the environment in which it resides.
- **Use edges and value the marginal:** The interface between things is where the most interesting events take place. These are often the most valuable, diverse and productive elements in the system.
- **Creatively use and respond to change:** We can have a positive impact on inevitable change by carefully observing, and then intervening at the right time.
- **Design from patterns to details:** By stepping back, we can observe patterns in nature and society. These can form the backbone of our designs, with the details filled in as we go.
- **Integrate rather than segregate:** By putting the right things in the right place, relationships develop between those things and they work together to support each other.
- **Use small and slow solutions:** Small and slow systems are easier to maintain than big ones, making better use of local resources and producing more sustainable outcomes.

SUSTAINABLE SITE PLANNING:

Site Selection is environmentally responsible.

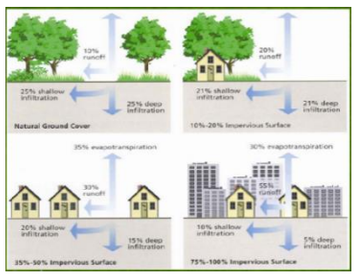
- Limit development within / on –
  - 100 yards flood plain
  - Prime farmlands
  - 100' of wetlands
  - 50' high quality of water bodies
  - Habitat of endangered or threatened species
- Select previously developed sites – grey fields & brown fields
- Select sites that encourage
- Use of public transport.

- **Building Orientation is optimised.**
- Energy saving of 25% +
- 8 degree can make significant difference
- Elongate on EW axis
- Maximise NS exposure for day lighting
- Minimise EW facing windows
- Orient most populated areas to N & S



Impervious Surfaces are minimised.

- Limit ground water recharge
- Increase pollutant load
- Increase runoff
- Create heat inland effect
- Minimise parking areas –
  - Zoning code min or less
  - Incorporate compact car spaces when possible
  - Reduce lane size
- Planting in & around parking areas
- Green roofs.
- Pervious paving options:
  - Pervious pavement
  - Pervious concrete
  - Permeable pavers
  - Grass pave system



Site Disturbance is minimised.

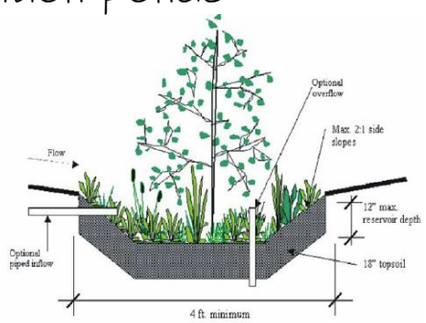
Grading & Slope:

- Parking – 2%
- Drives – 2 – 8%
- Vegetated slope – 3:1 or less
- Pervious pavements – 0-5%

Storm water quantity & quality is considered.

- Best management practices – Rain gardens / bio retention
  - Landscape islands
  - 4-10' + between parking rows
  - 8-10' for double loaded

- **Landscaping is water efficient & active.**
- Limit potable water use
  - Use native species
  - Place landscape areas to receive runoff
  - Use captured rainwater
  - Shade large hardscapes
  - Shade buildings in summer; allow sunlight in during winter
- Place to filter & clean stormwater
  - Raingarden in parking areas
  - Bioretention rather than retention ponds

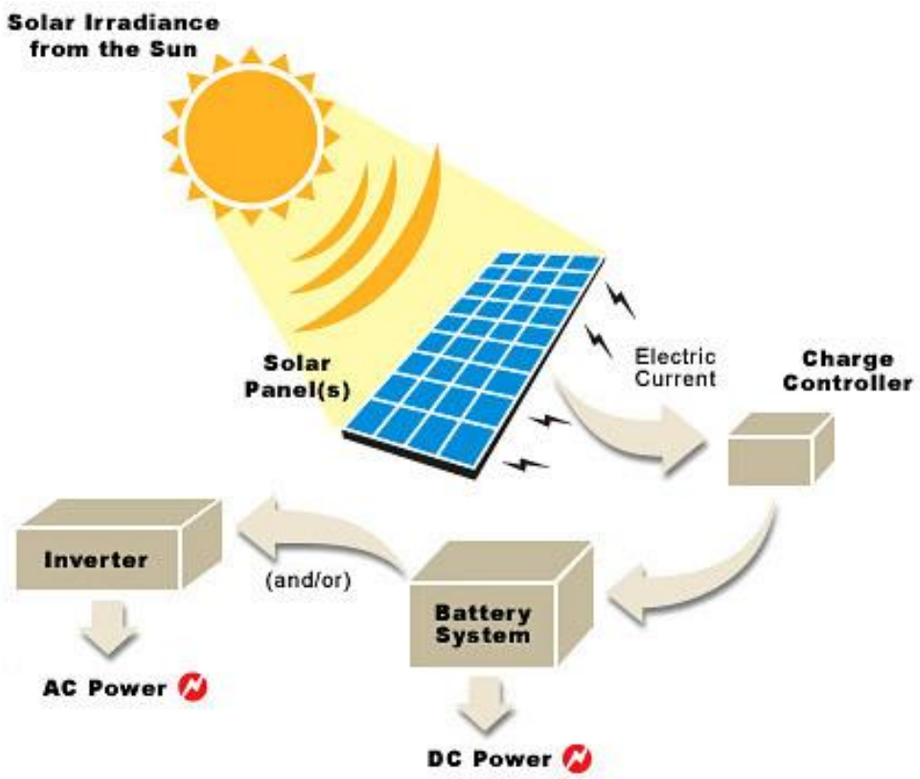


Nature (Flora and Fauna)

- As the pressure on land grows globally, it is important to recognise the value of natural environments. Nature contributes towards satisfying basic human needs and improving human quality of life in many ways.
- It plays a part in purifying our water and air, and helps moderate global and local climate by providing cooling, shading and shelter from winds.
- Natural environments affect people at a psychological and physical level.
- Protecting the ecosystems and the biodiversity they support is as important as protecting truly natural landscapes unaffected by humans. The loss of an ecosystem would mean the extinction of specific plant and animal species and a reduction in the biodiversity.

The main aim of a sustainable design or environment is to protect the existing ecosystems and the potential for developing new natural environments.
The links between a development site and other natural environments should also be considered.

Solar energy

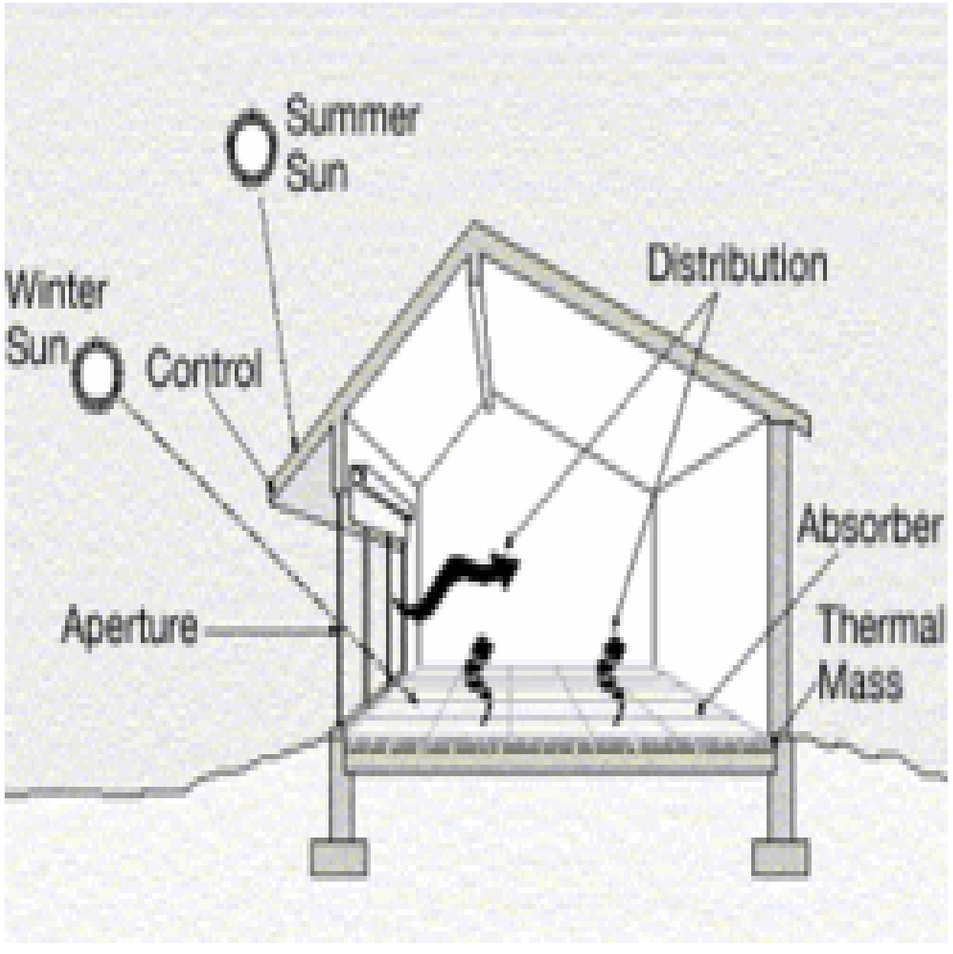


- Originally developed for energy requirement – Solar Power – has expanded in recent years for our domestic and industrial needs.
- Solar power is produced by collecting sunlight and converting it into electricity.
- This is done by using solar panels, which are large flat panels made up of many individual solar cells.
- It is most often used in remote locations, although it is becoming more popular in urban areas as well.

ENERGY EFFICIENCY

- **Efficient energy use**, sometimes simply called **energy efficiency**, is the goal to reduce the amount of energy required to provide products and services.
- For example, insulating a home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature.
- Reducing energy use is also seen as a solution to the problem of reducing greenhouse gas emissions.
- Energy efficiency and renewable energy are said to be the *twin pillars* of sustainable energy policy and are high priorities in the sustainable energy hierarchy.

- Save up to 30% energy consumption in the residential buildings and **40% in commercial buildings** by integrating energy efficient design
- Energy efficient design using climate responsive techniques in buildings can achieve thermal and visual comfort levels at low energy costs (EPI @25kWh/m2-yr for non-air-conditioned and 140kWh/m2-yr for air-conditioned buildings)
- Eco-friendly transportation on-site using electric vehicles results in 10 times cheaper running costs and 40% lower O$M costs in a span of 3 years as compared to petrol vehicles
- Institutional buildings adhering to ECBC provisions related to the Hyderabad climate, can save up to 50% of their annual energy requirement

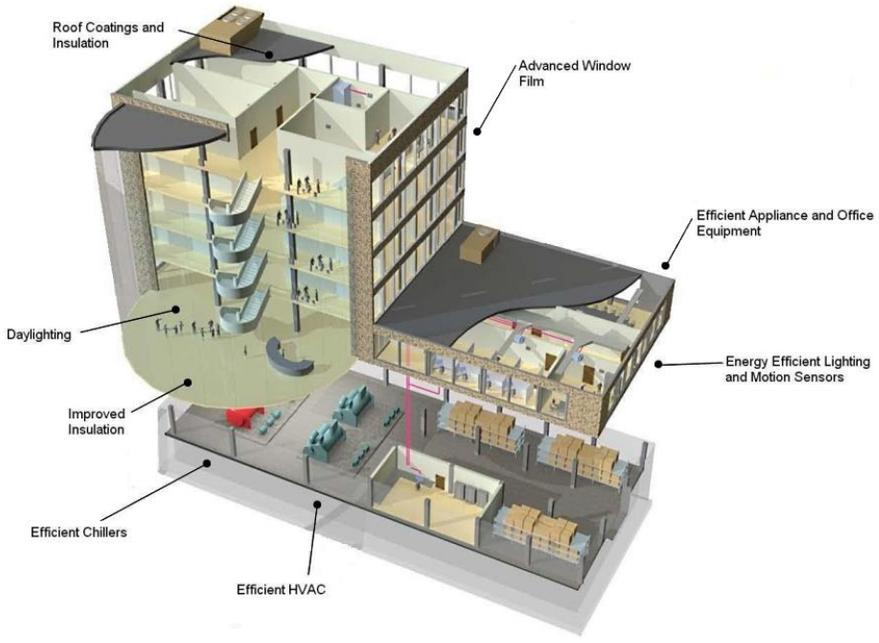


ENERGY EFFICIENCY

Various Methods To Achieve An Energy Efficient Building

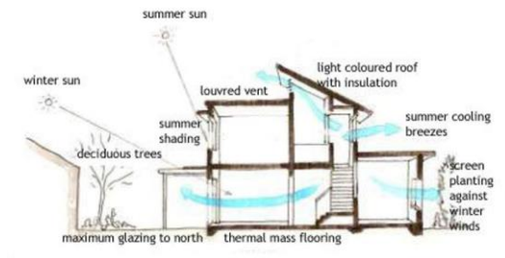
For Hot and dry climate: (Hyderabad)

- **Orientation:** Longer walls of building should face North & South so that the building gets minimum solar exposure.
- **Pressure balance for improved air circulation.**
- **Daylighting**
- **Improved insulation**
- **Efficient HVAC systems**
- **Energy efficient lighting**
- **Proper roof coating systems ,etc.**



Passive Cooling

Passive cooling is the least expensive means of cooling a home in both financial and environmental terms.

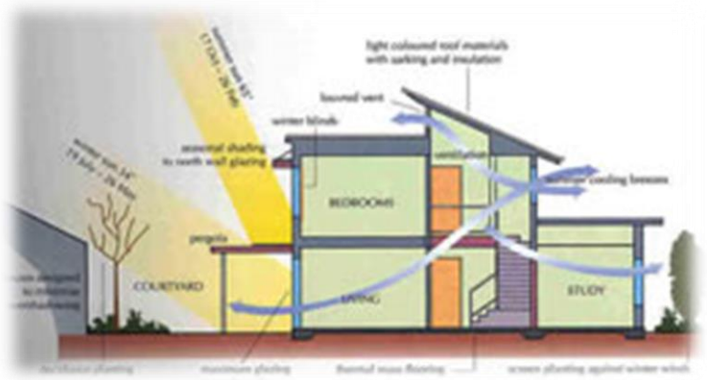


Some level of passive – cooling is required for every climate at some time of the year.

As cooling requirements are dictated by climate, distinctly different approaches to passive cooling are required for:

- **Hot humid climates:** where no heating is required.
- **Temperate and warm climates:** where both heating and cooling are required.
- **Cool and cold climates:** where heating needs are more important.

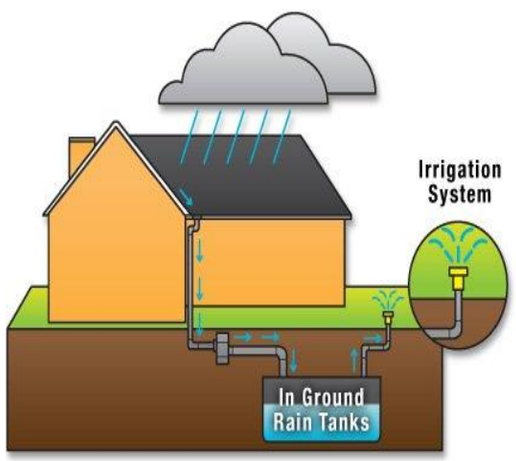
Use of passive cooling techniques in buildings for Hyderabad's climate, like evaporative cooling, passive downdraft cooling, thermal storage, night cooling, courtyard planning, earth air tunnel systems help in achieving thermal comfort

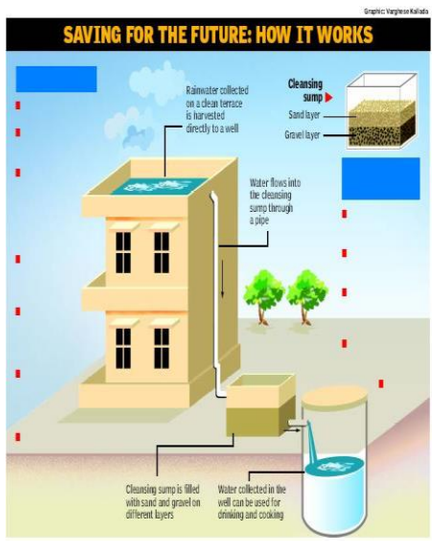


WATER CONSERVATION

Rainwater harvesting:

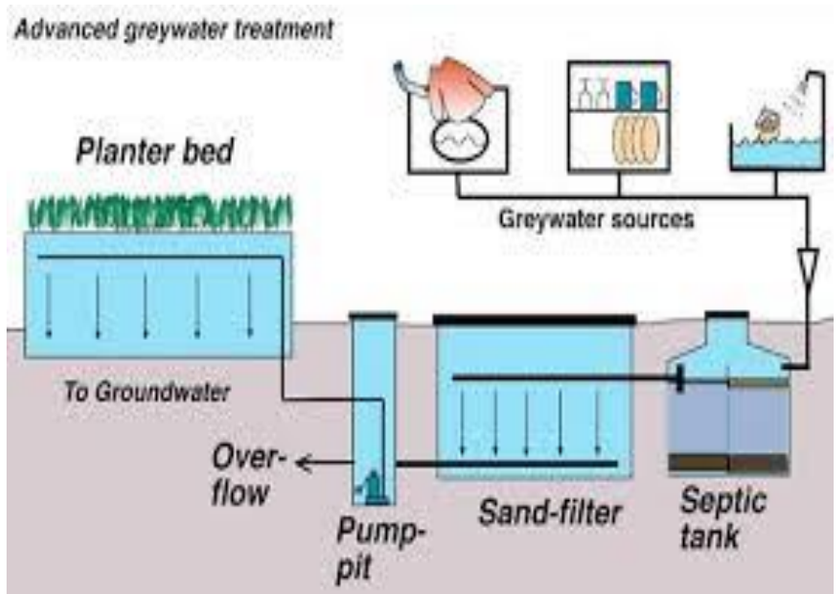
- Rainwater harvesting can **save upto 30% water** demand for a 4 member household residing in a building with **a roof area of 100 sqm** in Hyderabad
- Rainwater harvesting is the accumulating and storing of rainwater for reuse before it reaches the aquifer.
- It has been used to provide drinking water, water for livestock, water for irrigation, as well as other typical uses.
- It can supplement the subsoil water level and increase urban greenery.
- Water collected from the ground, sometimes from areas which are especially prepared for this purpose, is called storm water harvesting





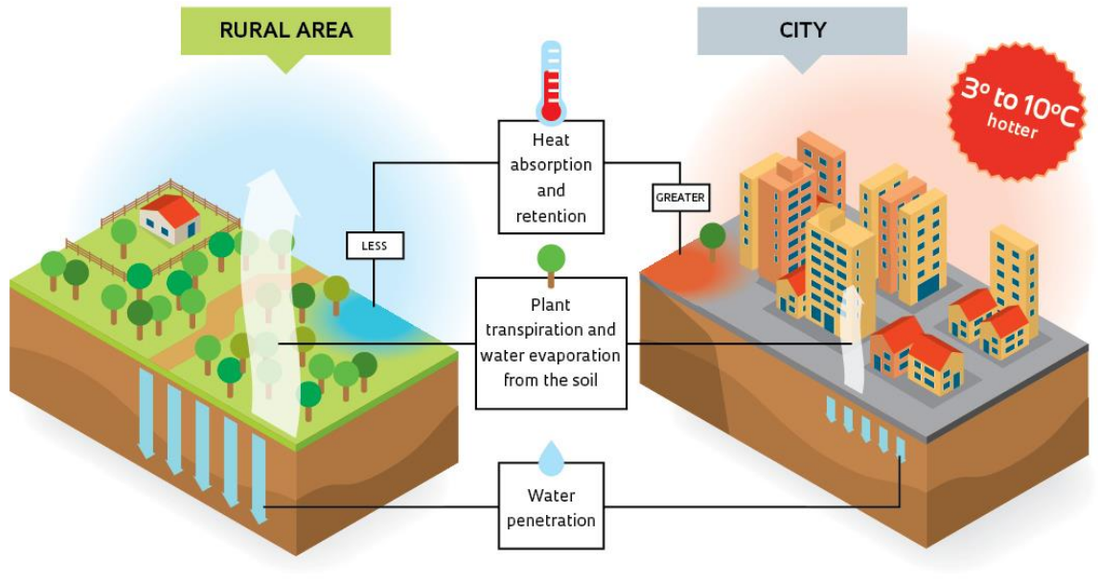
Waste Management

- Segregation of wastewater (grey & black) at source can **save upto 45%** of water demand in individual residential buildings
- Wastewater recycling and reuse can save upto 60% of water demand in apartment complexes, residential layouts, townships, institutional buildings and other large neighbourhoods
- Use of efficient fittings and pressure restrictors can save >30% of water consumption
- Water conserving practices can reduce the landscape water requirement by upto 60% in your premises
- Adherence to site contours and integrated approach to SUDS in neighbourhoods can reduce on-site storm water runoff by 40%



HEAT ISLAND EFFECT:

An **urban heat island** (UHI) is a city or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities.



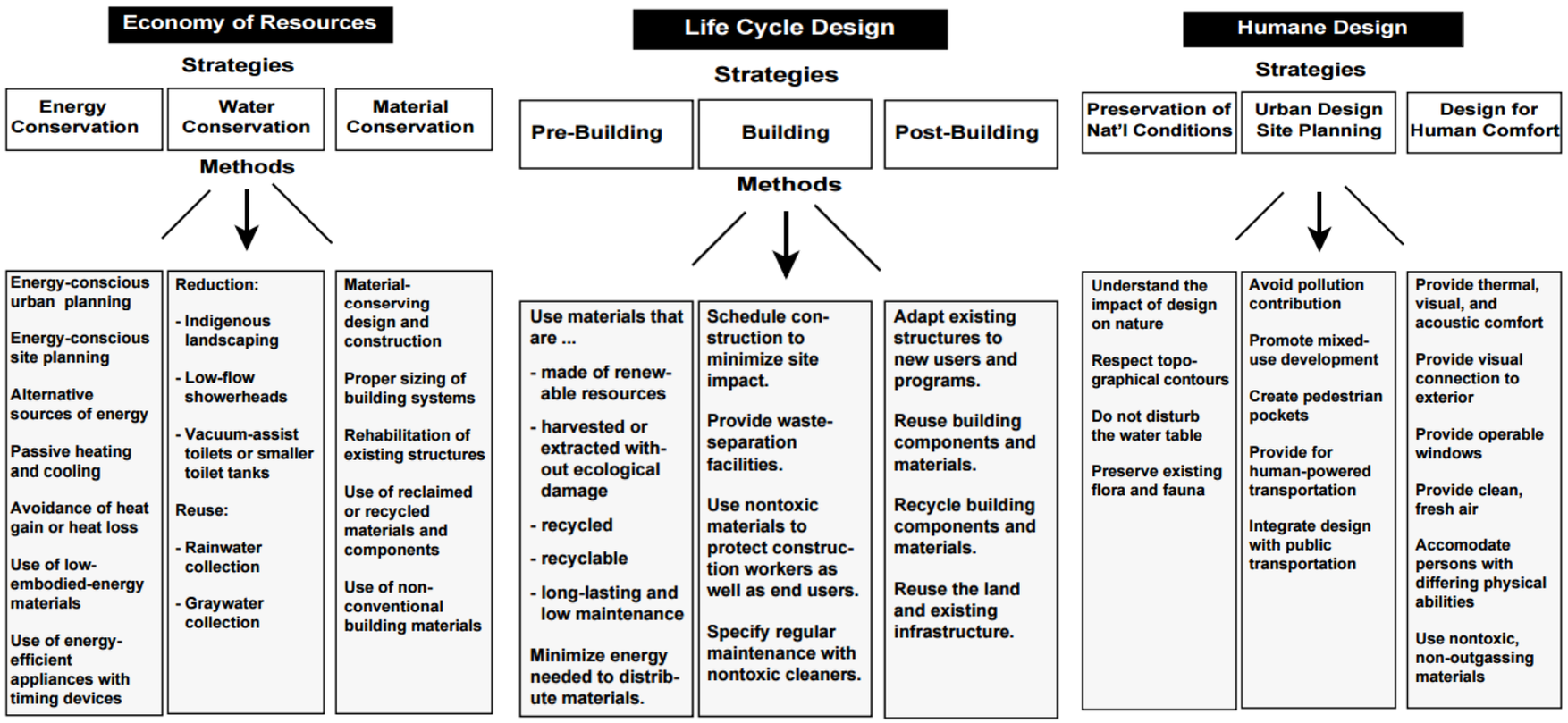
Strategies and Technologies

- **Trees and Vegetation** - Increasing tree and [illegible] by providing shade and cooling through evapotranspiration. Trees and vegetation can also reduce storm water runoff and protect against erosion.
- **Green Roofs** - Growing a vegetative layer (plants, shrubs, grasses, and/or trees) on a rooftop reduces temperatures of the roof surface and the surrounding air and improves storm water management. Also called "rooftop gardens" or "eco-roofs," green roofs achieve these benefits by providing shade and removing heat from the air through evapotranspiration.
- **Cool Roofs** - Installing a cool roof – one made of materials or coatings that significantly reflect sunlight and heat away from a building – reduces roof temperatures, increases the comfort of occupants, and lowers energy demand.
- **Cool Pavements** - Using paving materials on sidewalks, parking lots, and streets that remain cooler than conventional pavements (by reflecting more solar energy and enhancing water evaporation) not only cools the pavement surface and surrounding air, but can also reduce storm water runoff and improve night time visibility.
- **Smart Growth** - These practices cover a range of development and conservation strategies that help protect the natural environment and at the same time make our communities more attractive, economically stronger, and more livable.

QUALITY OF BUILT ENVIRONMENT

- Segregation of waste at source and treating organic waste on-site can reduce its collection upto 30%
- Effective recycling and reuse of construction waste for building activities on-site can reduce burden on landfill by upto 40%
- Preserving existing vegetation on-site wherever possible helps in reducing heat island effect and cost savings through reduced maintenance
- Use of fly ash in building components can reduce the usage of cement by upto 25% for various construction activities
- Conserving the ecological and geological formations on-site and integration by sensitive design wherever possible can help in retaining natural heritage of Hyderabad
- Use of low energy/recycled and locally available materials help in reducing stress on fossil fuels, non-renewable natural resources, transportation and other related costs

DESIGN CONSIDERATIONS FOR SUSTAINABILITY



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